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THE BATTLE OF BRITAIN

AUGUST–OCTOBER 1940

"*The gratitude of every home in our Island, in our Empire, and indeed throughout the world, except in the abodes of the guilty, goes out to the British airmen, who, undaunted by odds, unwearied in their constant challenge and mortal danger, are turning the tide of world war by their prowess and by their devotion. Never in the field of human conflict was so much owed by so many to so few.*"—THE PRIME MINISTER.

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THE BATTLE OF BRITAIN

An Air Ministry Account of the Great Days from
8th AUGUST—31st OCTOBER 1940

PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE, LONDON

DOCUMENTS

The Scene is Set

On Tuesday, 20th August, 1940, at 3.52 in the afternoon, the Prime Minister gave the House of Commons one of those periodic reviews on the progress of the war with which members in particular and the country in general have grown familiar. The occasion was grave. On 8th August, the Germans, after a period of activity against our shipping, which had lasted for somewhat longer than a month, had launched upon this island the first of a series of mass air attacks in daylight. For some ten days, and notably on the 15th and the 18th, men and women in the streets of English towns and villages and in the countryside had seen high up against the background of the summer sky the shift and play of aircraft engaged in the fierce and prolonged combat which has come to be known as the Battle of Britain.

The House was crowded. Its mood was one of anxious enthusiasm; but enthusiasm waxed and anxiety waned as the Prime Minister proceeded to describe the swiftly changing movements of the battle, the opening stages of which some of the members had themselves witnessed.

After referring to the work and achievements of the Navy, Mr. Winston Churchill turned to the war in the air. "The gratitude of every home in our Island," he said, "in our Empire, and indeed throughout the world, except in the abodes of the guilty, goes out to the British airmen, who, undaunted by odds, unwearied in their constant challenge and mortal danger, are turning the tide of world war by their prowess and by their devotion. Never in the field of human conflict was so much owed by so many to so few."

The Prime Minister was speaking at a moment when the battle was still at its height, for it was not until the end of October that the German Luftwaffe virtually abandoned its attacks by daylight and began to rely entirely on a policy of night raiding—its tacit admission of defeat.

It is now possible to tell, in great part, the story of the action on which such high praise had been bestowed. Before doing so, however, it is worth while to recall the extraordinary nature of the battle. Nothing like it has ever been fought before in the history of mankind. It is true that aircraft frequently met in combat in the last war; but they did so in numbers very small when compared with those which were engaged over the fields of Kent and Sussex, the rolling country of Hampshire and Dorset, the flat lands of Essex and the sprawling mass of London. Moreover, from 1914 to 1918 fights took place either between individual aircraft or between small formations, and an engagement in which more than a hundred aircraft on both sides were involved was rare even in the later stages of the war. The issue was, in fact, decided not in the air, in which element the rival air forces played an important but secondary part, but by slow-moving infantry in the heavy mud of Flanders and the Somme. It may be that the same thing, or something like it, will ultimately happen in the present war. Up to the moment, however, the first decisive encounter between Britain and Germany has taken place in the air and was fought three, four, five, and sometimes more than six miles above the surface of the earth by some hundreds of aircraft flying at speeds often in excess of three hundred miles an hour.

While this great battle was being fought day after day, the men and women of this country went about their business with very little idea of what was happening high up above their heads in the fields of air. This battle was not shrouded in the majestic and terrible smoke of a land bombardment with its roar of guns, its flash of shells, its fountains of erupting earth. There was no sound nor fury—only a pattern of white vapour trails, leisurely changing form and shape, traced by a number of tiny specks scintillating like diamonds in the splendid sunlight.

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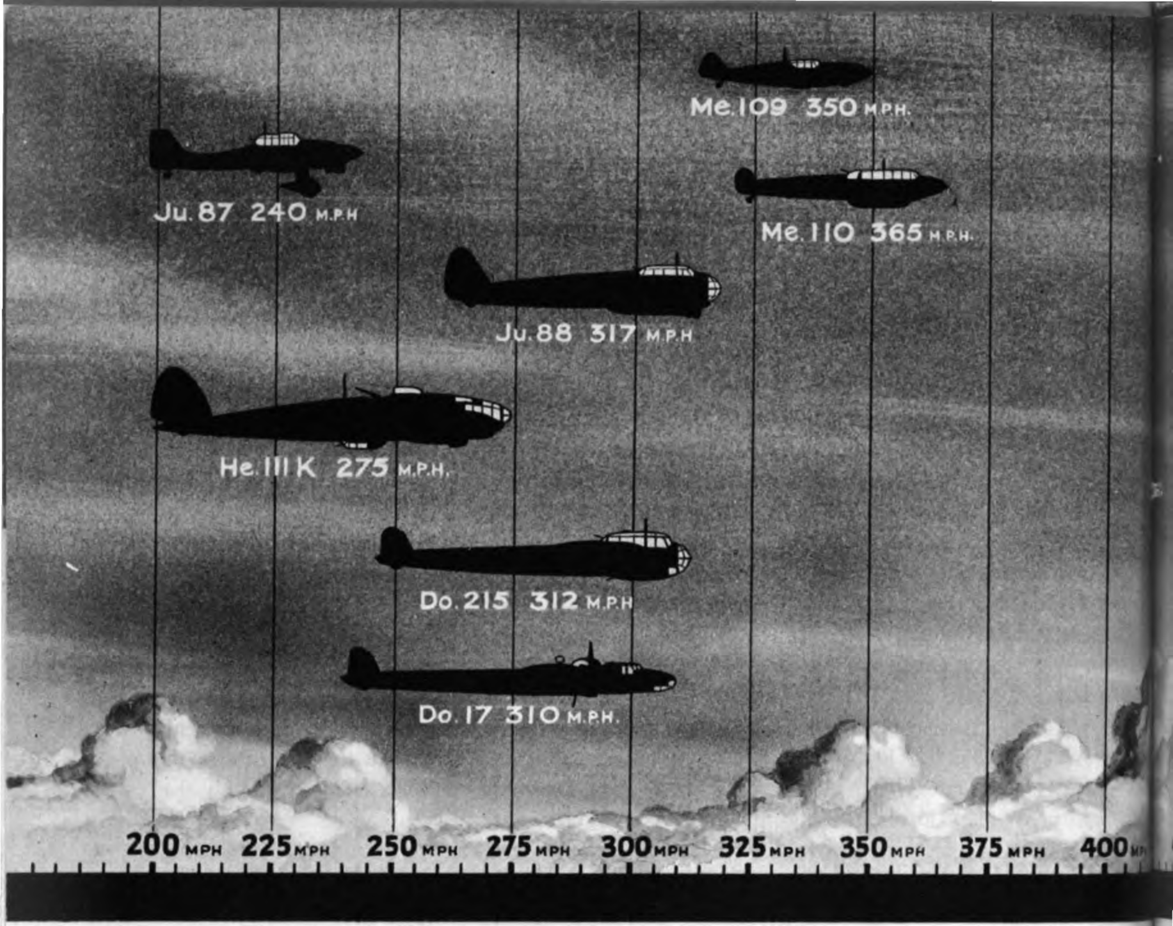
From very far away there broke out from time to time a chatter against the duller sound of engines. Yet had that chatter not broken out, that remote sound would have changed first to a roar and then to a fierce shriek, punctuated by the crash of heavy bombs as bomber after bomber unloaded its cargo. In a few days the Southern towns of England, the capital of the Empire itself, would have suffered the fate of Warsaw or Rotterdam.

The contest may, indeed, be likened to a duel with rapiers fought by masters of the art of fence. In such an encounter the thrusts and parries are so swift as to be often hard to perceive and the spectator realises that the fight is over only when the loser drops his point or falls defeated to the ground.

THESE WERE THE WEAPONS USED

Before we can understand the general strategy and tactics followed by both sides, something must be said of the weapons used. The Germans sought a decision by sending over five main types of bombers—the Ju. 87, a dive-bomber, the Ju. 88, various types of the Heinkel 111, the Dornier 215 and the Dornier 17. The Ju. 87 type B was a two-seater dive-bomber. It was an all-metal, low-wing cantilever monoplane, armed with two fixed machine-guns, one in each wing, and a movable machine-gun in the aft cockpit. When looked at from straight ahead the wings had the shape of a very flat W. Its maximum speed in level flight was a trifle over 240 miles an hour. The Ju. 88 was also a dive-bomber with a maximum speed of 317 m.p.h. Its crew and armament were similar to those of the Heinkel 111. The Heinkel 111k Mark V. was a low-wing all-metal cantilever monoplane with two engines. It carried a crew of four and was armed with three movable machine-guns, one in the nose, one on the top of the fuselage and one in the streamlined " blister " underneath. Its maximum speed was nearly 275 m.p.h. The Dornier 215 was a high-wing cantilever monoplane of all-metal construction with three movable machine-guns similarly placed to those of the Heinkel 111k. Its maximum speed was about 312 m.p.h. It was a development of the Dornier 17, familiarly known as " the flying pencil." This aircraft was a mid-wing cantilever monoplane. It was armed with two fixed forward-firing machine-guns in the fuselage, one movable gun in the floor and one on a shielded mounting above the wings. Its maximum speed was about 310 m.p.h. Variations and increases in armament were constantly made in all these aircraft which carried the bombs intended to secure victory. These bombers were protected by fighters of which the Germans used two main types, the Me. 109 and the Me. 110. The Me. 109 in the form then used was a single-seater fighter. It was a low-wing all-metal cantilever monoplane armed with a cannon firing through the airscrew hub, four machine-guns and two more in troughs on the top of the engine cowling. Its maximum speed was a little more than 350 m.p.h. Its pilot was later protected by back and front armour of which the size and shape became standardized during the course of the battle. The Me. 110 was a two-seater fighter powered with two engines. It was an all-metal low-wing cantilever monoplane with two fixed cannons and four fixed machine-guns to fire forward from the nose. It was much larger than the Me. 109 but had not got the same capacity of manœuvre. Its maximum speed did not exceed 365 m.p.h. In this aircraft the crew were protected by back armour only. The Germans also used a few Heinkel 113's. This was a low-wing all-metal cantilever monoplane with a single engine. A cannon fired through the airscrew hub and there were two large-bore machine-guns in the wings. The maximum speed was about 380 m.p.h.

To combat this formidable array of fighters and bombers, which Göring had boasted were " definitely superior " to any British aircraft, the Royal Air Force used the Spitfire, the Hurricane and



GÖRING'S BOAST: "OUR AIRCRAFT ARE DEFINITELY SUPERIOR"

occasionally the Boulton-Paul Defiant.

The Spitfire Mark I was a single-seater fighter with a Rolls-Royce Merlin engine. It was a low-wing all-metal cantilever monoplane armed with eight Browning machine-guns, four in each wing set to fire forward outside the airscrew disc. The maximum speed was 366 m.p.h.

The Hawker Hurricane Mark I. was also a single-seater fighter similarly engined and armed. Its maximum speed was 335 m.p.h. In both these aircraft the pilot was protected by front and back armour. The Boulton-Paul Defiant was a two-seater fighter with a Rolls-Royce engine. It was an all-metal low-wing cantilever monoplane, and was armed with four Browning machine-guns mounted in a power-operated turret.

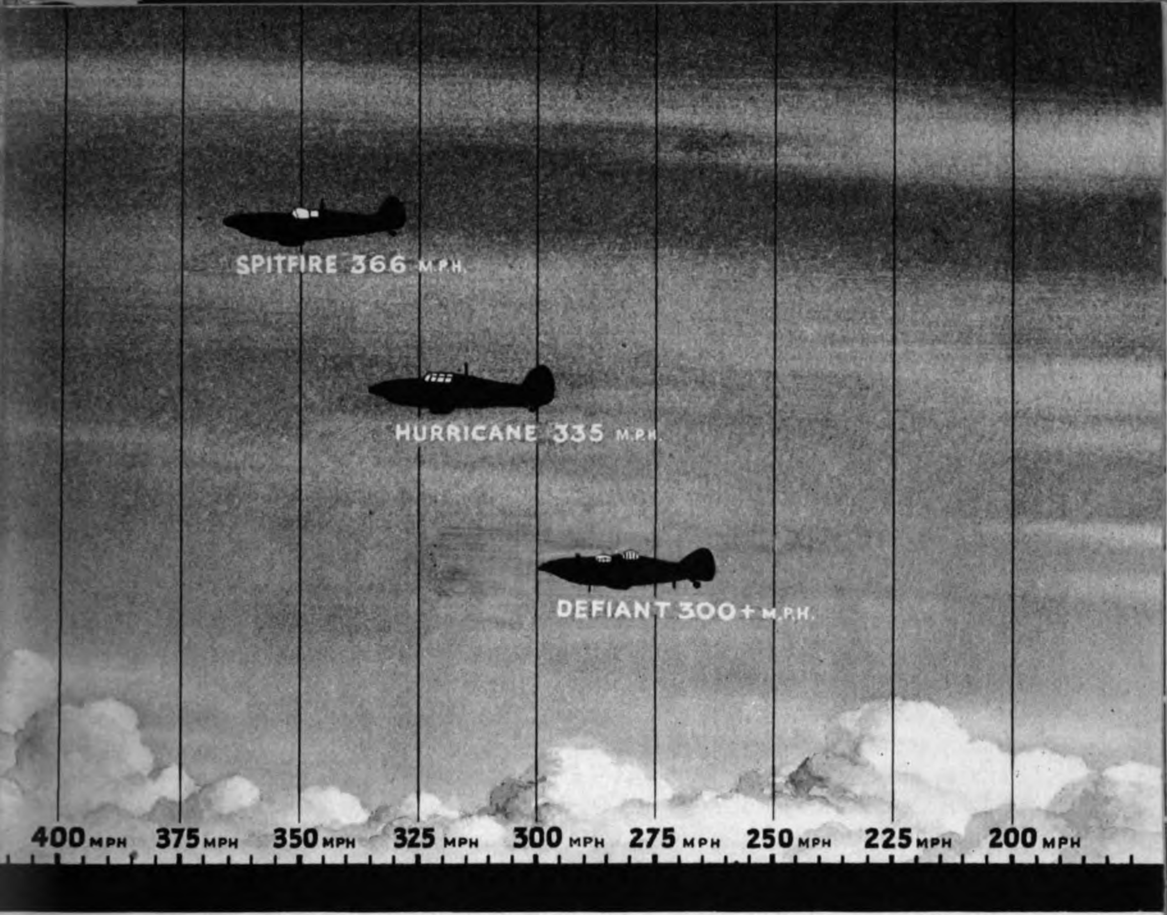
With such machines as these the Royal Air Force and the Luftwaffe faced each other on 8th August when the battle began.

THE BRITISH FIGHTER FORCE ON GUARD

Before describing it something must first be said about our methods of defence, although it is not easy to do this without giving away " state secrets."

The governing principle is that a sufficient strength of Fighters must be assembled at the required height over a given place where it can intercept the oncoming enemy raid and break it up before it can reach its objective.

There is general agreement that the principle of employing Standing Patrols is impracticable owing to its wastefulness. To keep a sufficient strength of Fighters always in the air to guard our shores from any attack would be beyond the powers of the biggest Air Force imaginable. The Fighter Force is therefore kept on the ground in the interests of economy of effort, and only ordered off the ground



BRITAIN'S ANSWER: "'SPITFIRE,' 'HURRICANE,' 'DEFIANT'"

when raids appear to be imminent.

Information regarding the approach of the enemy is obtained by a variety of methods and is co-ordinated and passed to "Operations Rooms." The coastline of Britain is divided into Sectors each with its own Fighter Aerodromes and Headquarters. These Sectors are grouped together under a conveniently situated Group Headquarters which in its turn comes under the general control of Headquarters, Fighter Command. The information about enemy raids is illustrated by various symbols on a large map table in Group and Sector Operations Rooms, the aim being to give each "Controller" the same picture of the progress of raids in his particular area. In addition to this the Controllers have all possible information set out before them, such as the location and "state" of their own Squadrons, the weather and cloud conditions all over their area. They are also in touch with the Anti-aircraft Defences and the Balloon Barrages.

"RELEASED," "READY" AND "STAND-BY"

Squadrons are maintained at their Sector Aerodromes at various "states of preparedness." The most relaxed state is "released," which means that the Squadron is not required to operate until a specified hour and that the personnel can be employed in routine maintenance, flying training and instruction, organised games, and that in some cases they may leave the Station. Next comes "Available," which means the Squadrons must prepare to be in the air within so many minutes of receiving the order. "Readiness" reduces this to a minimum and is the most advanced state normally used. Occasionally "Stand-by" is employed which means that the pilots are seated in their aircraft, with the engines "off," but all pointing into wind ready to start up, and take off, the moment the leader gets his orders from the Controller.

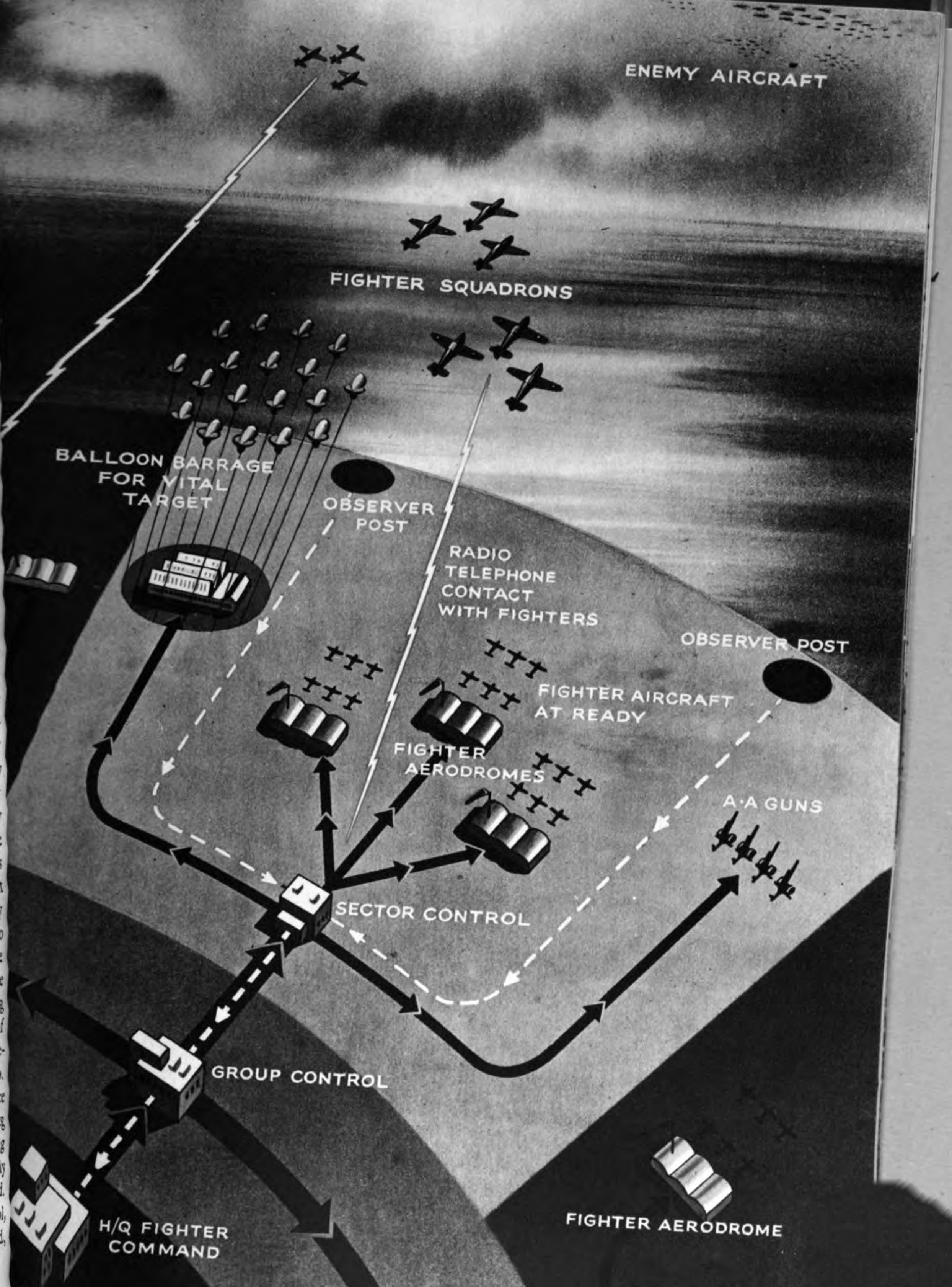
In good weather conditions and when there is reason to anticipate an attack, Squadrons are perforce kept at a high state of "preparedness" which is relaxed as much as possible when the weather deteriorates. The broad principle is usually to keep one part of the force at "Readiness," a second part at "Advanced Available" and a third at "Normal Available." When the attack develops, the "Readiness" Squadrons are ordered off in appropriate formations and the "Available" Squadrons are ordered to "Readiness" and used as a reserve to meet a second or a third attack or to protect aerodromes or vulnerable points such as aircraft factories.

These orders are issued by the Controller whose function it is to study the Operations Room Map and put a suitable number of aircraft into the air at selected points to intercept the oncoming raids, or to cover vulnerable points. His duty also is to keep a constant watch on his resources so as not to run the risk of being caught by a third or fourth wave of raids, with all his Squadrons on the ground "landed and refuelling." It must be remembered that the endurance of a modern Fighter aircraft, if it is to have ample margin for full throttle work, climbing and fighting, is limited. Allowance must also be made for the journey back to the parent station especially if visibility is bad.

With the tracks of the enemy raid and of his own Fighters both before his eyes, the Controller's task of making an interception is in theory a comparatively simple mathematical problem. He is in constant touch with his Fighters by radio telephone, is able to give them orders to change course from time to time, so as to put them in the best position for attack.

Once the Fighters report that they have "sighted the enemy," the Controller's task is over, except that he may have to give them a course to bring them back to their aerodromes when the battle is over. The "enemy sighted" signal, the "Tally-ho," is at once transmitted to Group H.Q. and recorded on the Squadron state indicator. The Red Letter day for any Group was on 27th September, when, in No. 11 Group, 21 Squadrons out of 21 ordered up were able to report "enemy sighted." But the successful interception of raids is not always so easy. In practice exercises before the war, thirty per cent. interception was thought satisfactory and fifty per cent. very good. When the test came, however, the percentage rose to seventy-five, ninety, and sometimes a hundred. This consistently high rate of interception made it possible for our superiority in pilots and aircraft to achieve its full effect.

The task of the Controller in setting the stage for the battle is governed by one factor—accurate and timely information about the raids. In clear weather with little or no cloud, the raiders came over at such high altitude that they were almost invisible even with the use of binoculars. The numbers of aircraft employed made a confusion of noise in the high atmosphere and thus increased the difficulty of detecting raids by sound. In cloudy weather this difficulty was increased, for the Observer Corps had then to rely entirely on sound. In view of these difficulties, that Corps and other sources of information deserve very great credit for the remarkably clear, and timely picture of the situation they presented to the Controllers. These, then, set the pieces on the wide chessboard of the English skies and made the opening moves in the contest on the outcome of which the safety of all free peoples depended. Flexibility was their motto. Each day the Controllers held a conference at which every idea or device for thinking and acting one step ahead of their cunning and resourceful foe was set forth, earnestly discussed and, if found useful, adopted. Without this system of central control, no battle, in the proper sense of the word,



INTRICATE AND FLEXIBLE: THE OPERATIONS CONTROL

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would have taken place. Squadrons would have gone up haphazard as and when enemy raids were reported. They would either have found themselves heavily outnumbered or with no enemy at all confronting them.

Great care was taken to keep the burden of the fight distributed as equally as possible between all the Squadrons engaged. This was achieved by hard training which continued right through the battle. Whenever there was a lull, new formations were devised and flown, new tactics practised. No Squadron was ever thrown into the fight without previous experience of fighting. They were carefully " nursed " and went into action under the leadership of an experienced squadron leader with many hours of combat to his credit. The importance of team work was fully realised. It was a lesson learnt in France during the battles of May and June, and fortunately many of the pilots who had fought in them were in positions of command during the Battle of Britain. Their knowledge and experience were invaluable.

THE GERMAN COMMAND PLANS A KNOCKOUT

The avowed object of the enemy was to obtain a quick decision and to end the war by the autumn or early winter of 1940. To achieve this an invasion of Britain was evidently thought to be essential. Preparations to launch it were pushed forward with great energy and determination throughout the last days of June, the month of July and the first week of August. By the 8th August the enemy felt himself ready to begin the opening phase, on the success of which his plan depended. Before the German Army could land it was necessary to destroy our coastal convoys, to sink or immobilise such units of the Royal Navy as would dispute its passage, and above all to drive the Royal Air Force from the sky. He, therefore, launched a series of air attacks, first on our shipping and ports and then on our aerodromes. There were four phases in the battle, the first from 8th–18th August, the second from the 19th August–5th September, the third from the 6th September–5th October, the fourth from the 6th–31st October. During this last phase daylight attacks gave way gradually to night raids which increased as the month went on. It should, however, be remembered that throughout the battle the enemy made use of night as well as day bombing, the first growing in volume and violence as the second fell away.

What was the plan which he sought to carry through in these four phases ? It is impossible to say with certainty at this moment. The German mind is very methodical and immensely painstaking. Schemes are worked out to the last detail ; the organisation is superb and, provided the calculations are correct, the plan goes without a hitch. But again and again history has shown that, if the original plan fails or becomes impracticable, the German has little power of improvisation, and " if the trumpet give an uncertain sound, who shall prepare himself to the battle ? " A brand new plan has to be worked out in full detail, and when this has been done it may well be too late. In this instance the Luftwaffe was designed to prepare the way for the German Army by smashing the enemy's resistance, and it was a fundamental assumption in Berlin that Germany could in every case establish and maintain air supremacy.

The general plan for the use of the Luftwaffe was to seize and exploit the full mastery of the air. This was the main feature in the Polish campaign, in the attacks on Norway and the Low Countries, and even to a large extent in France. Aerodromes were to be put out of action, thus tying the opposing Air Forces to the ground. Ports and communications could then be destroyed without hindrance, the military forces of the enemy paralysed and the German armoured divisions placed in a position to operate undisturbed. Success meant the destruction of civilian morale, and then internal disruption and surrender.

PHASE I

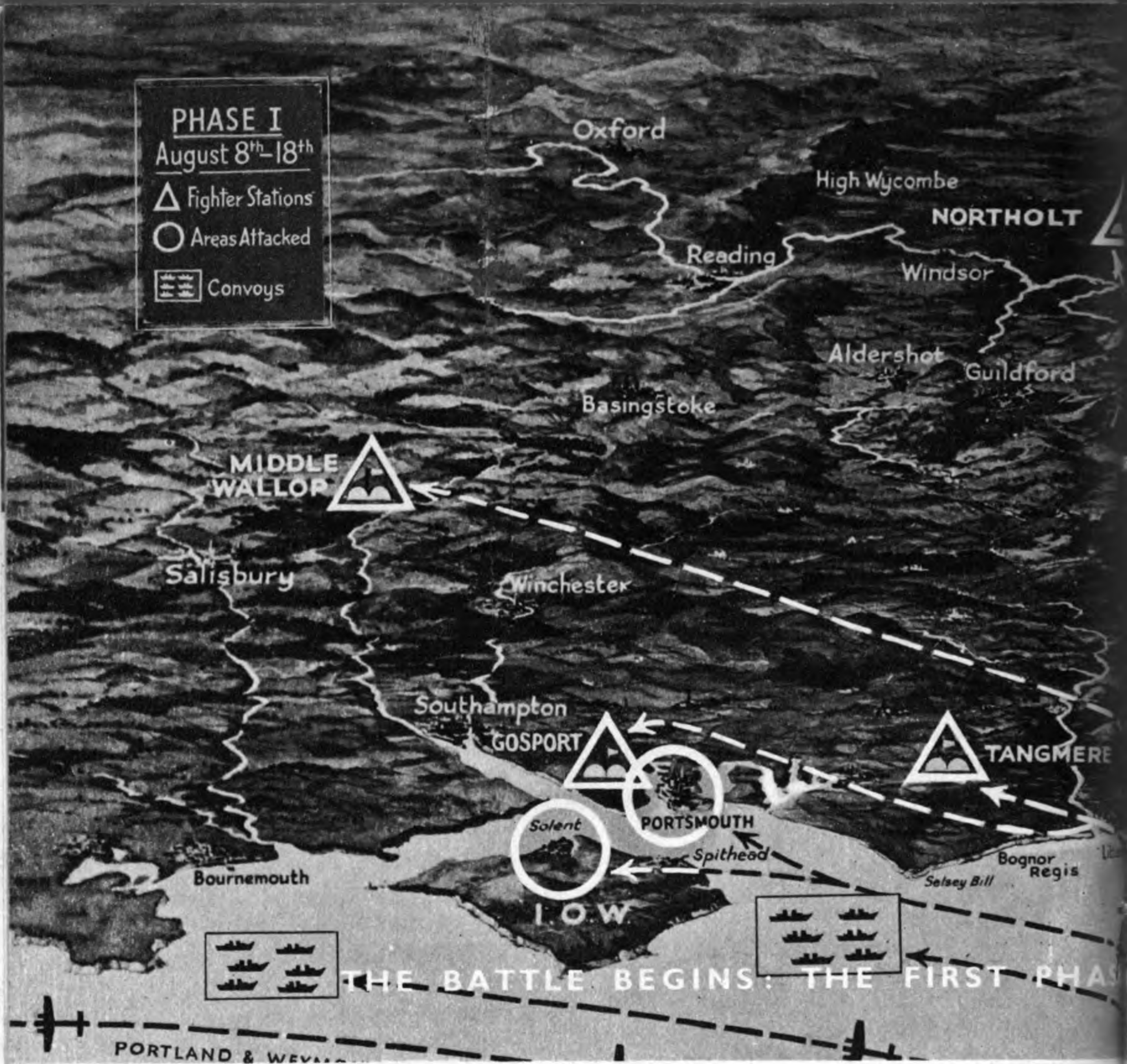
The Offensive is Launched

In the first stage the enemy sent over massed formations of bombers escorted by similar formations of single- and twin-engined fighters. The bombers were for the most part Ju. 87's (dive-bombers), with a smaller quantity of He. 111's, Do. 17's and Ju. 88's. The fighter escorts flew in large, unwieldy formations, from 5,000–10,000 feet above the bombers, where the protection they afforded was not very effective. Using these tactical formations the enemy made twenty-six attacks during this first stage. He began by renewing his assaults on our shipping. It may well be that this was still regarded as the most vulnerable form of target and the easiest to attack, for not only are slow-moving ships difficult to defend, but casualties among the pilots of the defence are always higher when the action is fought over water. He may also have wished to test the strength of our general defences. Success against these would augur well for the next stage. At any rate, on 8th August two convoys were fiercely attacked, one of them twice. Sixty enemy aircraft in the morning and more than a hundred soon after midday, deployed on a front of over twenty miles, tried to sink or disperse a convoy off the Isle of Wight. They succeeded in sinking two ships. In the afternoon at 4.15 more than a hundred and thirty appeared over another convoy off Bournemouth. This they were able to disperse, but they lost fairly heavily in doing so. The enemy renewed the assault three days later, choosing as his targets the towns of Portland and Weymouth, as well as convoys in the Thames Estuary and off Harwich. In these attacks he relied greatly on dive-bombers, which proved no match for our Hurricanes. Nevertheless some damage was done both in Portland and Weymouth. This may have encouraged him, for on 12th August, early in the morning, he launched about two hundred aircraft in eleven waves against Dover. Shortly before noon a hundred and fifty more of the enemy attacked Portsmouth and the Isle of Wight. By this time German losses were already very considerable, for one hundred and eighty-two aircraft had been destroyed.

On the 13th and 15th the attacks on Portsmouth were renewed and in some of them, notably that which began soon after 5 in the afternoon of the 15th, between three and four hundred aircraft were employed. The enemy was by now beginning to realise that our fighter force was considerably stronger than he had imagined. It was evidently time to take drastic action. Our fighters must be put out of commission. Therefore, while still maintaining his attacks on coastal towns, he sent large forces to deal with fighter aerodromes in the South and South-East of England; Dover, Deal, Hawkinge, Martlesham, Lympne, Middle Wallop, Kenley and Biggin Hill were heavily attacked, some of them many times. A number of the enemy penetrated as far as Croydon.

GERMAN LOSSES RUN INTO HUNDREDS OF AIRCRAFT

Once more the Luftwaffe did a certain amount of damage but at a cost which even Göring must have regarded as excessive. On that day, 15th August, a hundred and eighty German aircraft are known to have been destroyed. Since the opening of the battle he had now lost four hundred and seventy-two aircraft. Nevertheless he still returned to the charge, throwing in between five and six hundred aircraft on 16th August and about the same number on 18th. Rochester, Kenley, Croydon, Biggin Hill, Manston, West Malling, Gosport, Northolt and Tangmere, were the main targets. His losses were again very heavy. In those two days two hundred and forty-five aircraft were shot

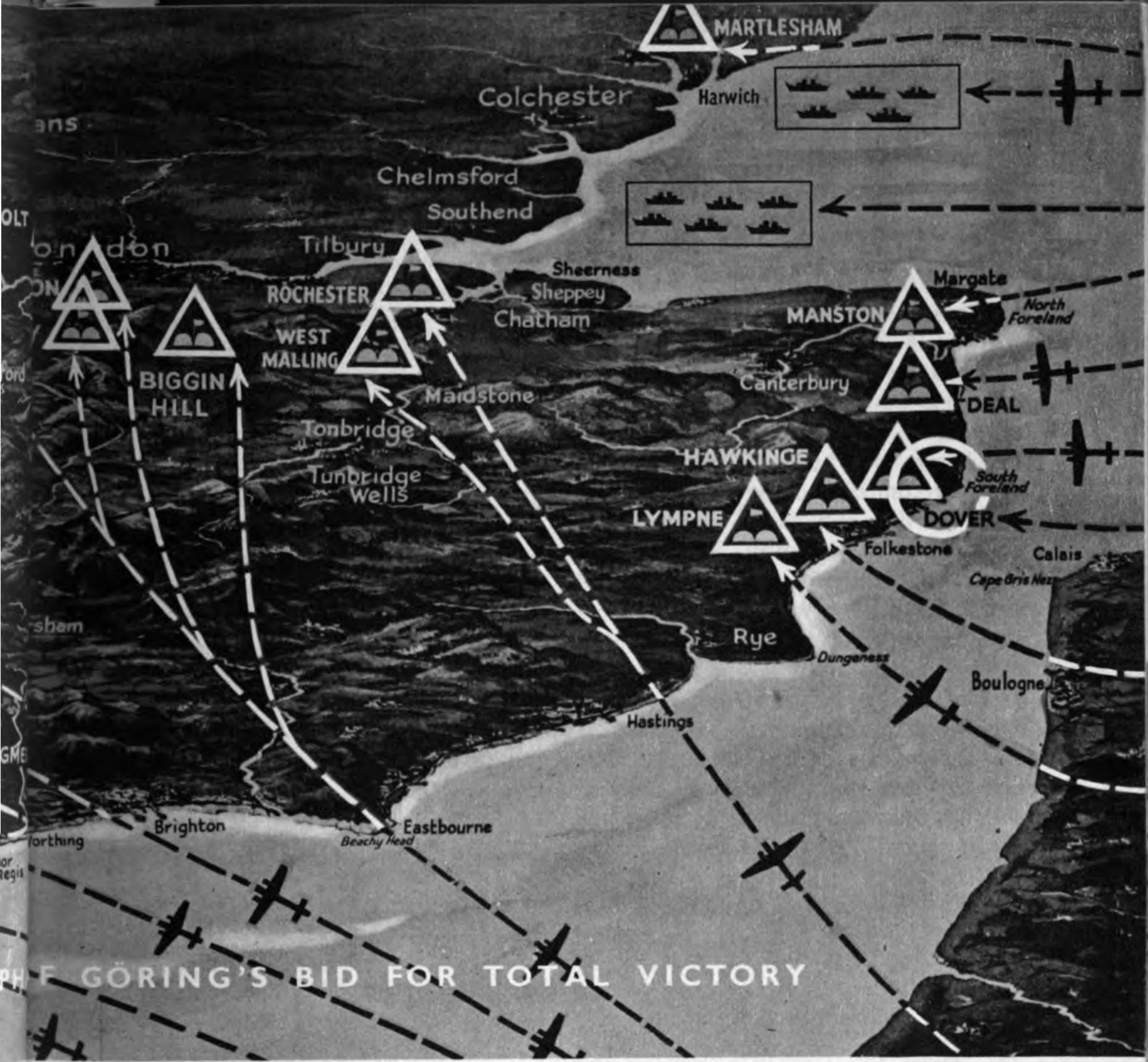


down. One of them, a Heinkel 111, fell to a Sergeant pilot flying an unarmed Anson aircraft of Training Command. Whether he intentionally rammed the enemy will never be known, for both aircraft fell to the ground interlocked and there were no survivors. On 18th August, in the evening attack on the Thames Estuary, one Squadron alone of thirteen Hurricanes shot down without loss an equal number of the enemy in fifty minutes.

In the ten days since the opening of the attack on 8th August, Göring had now lost six hundred and ninety-seven aircraft. Our own losses during the same period were not light, for we lost one hundred and fifty-three. Sixty pilots were safe though some of them were wounded.

The pace was too hot to last. Göring called halt and gave his Luftwaffe a rest which lasted for five days.

What had he hoped to achieve? An examination of the attacks shows that he began by trying to destroy shipping and ports on the South-East and South Coasts between the North Foreland and Portland. This preliminary test must have shown him the strength of our defences. Nevertheless he proceeded with his plan and next directed his attention to Portland and Portsmouth. Whether these objectives were too tough for him or whether he thought that the four heavy attacks upon them had accomplished his object, he turned away to deliver assaults on fighter and bomber aerodromes mostly near the coast. Throughout this first stage the tactics he followed were usually to open



his attack on objectives near the coast in order to draw off our fighters. These feint attacks were followed thirty or forty minutes later by the real attack delivered against ports or aerodromes on the South Coast between Brighton and Portland.

The chief problem created by these tactics was to have a sufficient number of fighters ready to engage the main attack as soon as it could be picked out. Squadrons at the forward aerodromes had to be in instant readiness, but had at the same time to be protected from bombing or machine-gun attacks. Only on one occasion was a Squadron machine-gunned while re-fuelling at a forward aerodrome, and this happened because a protective patrol had not been maintained overhead during the process.

Generally the enemy attacks were countered by using about half the available Squadrons to deal with the enemy fighters and the rest to attack the enemy bombers which flew normally at from 11,000-15,000 feet, descending frequently to 7,000 or 8,000 feet in order to drop their bombs. Our fighter tactics at this stage were to deliver attacks from the stern on the Me. 109's and Me. 110's. This type of attack proved effective because these aircraft were not then armoured. The success of our fighter tactics at this stage can be gauged by a comparison between our losses in pilots and those of the enemy. The ratio was about seven to one and might have been even more striking if so much of the fighting had not taken place over the sea.

PHASE II

The Attack on Inland Aerodromes

Between the end of the first stage and the active beginning of the second there was, as has been said, an interval of five days which were spent by the Germans in widespread reconnaissance by single aircraft, some of which indulged in the spasmodic bombing of aerodromes. These operations cost them thirty-nine aircraft shot down. Our losses were ten aircraft, but six pilots were saved.

During this lull, Göring evidently decided that a change of objectives was necessary. Perhaps he thought that he had achieved the necessary results, and that Portland and Portsmouth together with our coastal aerodromes were virtually out of action. Perhaps he was under the impression that inland aerodromes, factories and other industrial targets would not be as stoutly defended. It is more probable, however, that he merely gave the order for the second part of the plan to be put into operation and disregarded the failure of the first part—either deliberately, or because he had no alternative. In this next stage diversionary attacks against different parts of the country became less frequent. The main attack was now delivered on a wider front. Enemy tactics were also changed. The number of escorting fighters was increased and the size of bomber formations reduced. The covering fighter screen flew at very great heights. Enemy bomber formations were also protected by a box of fighters, some of which flew slightly above to a flank or in rear, others slightly above and ahead, and yet others weaving in and out between the sub-formations of the bombers. This type of formation succeeded on several occasions in breaking through the forward screens of our fighter forces by sheer weight of numbers and in attaining their objectives even after numerous casualties had been inflicted. On other occasions smallish formations of enemy long-range bombers deliberately left their fighter escort as soon as it had joined battle and proceeded towards South or South-West London unaccompanied. They suffered heavy casualties when engaged by our rear rank of fighters.

Having thus altered his tactical formations the enemy proceeded to deliver some thirty-five major attacks between the 24th August and 5th September. His object, as has been said, was to put out of action inland fighter aerodromes and aircraft factories. He did not, however, disdain purely residential districts in Kent, the Thames Estuary and Essex. These could in no case be described as of military importance.

EIGHT HUNDRED AIRCRAFT ATTACK FIGHTER AERODROMES

From 24th to 29th August he still showed an interest in Portland, Dover and Manston, all of which were heavily attacked. He added other targets as well. Several areas in Essex came in for attention. There was fierce fighting over the North Foreland, Gravesend and Deal. At 6.45 p.m. on the 24th, a hundred and ten German bombers and fighters met a number of our Squadrons in the neighbourhood of Maidstone, but turned and fled before they could be engaged.

The next day he returned to Portsmouth and Southampton where once again he achieved no success, the main attack, delivered at 4 p.m., going astray. A large number of bombs fell into the sea. Heavy assaults were also made in the Dover-Folkestone area, and over the Thames Estuary and in Kent. These continued with a lull of one day until 30th August. On that day and the next the assault was switched to inland fighter aerodromes. Eight hundred aircraft were used in a most determined effort to destroy or temporarily put out of use the aerodromes at Kenley, North Weald, Hornchurch,

Debden, Lympne, Detling, Duxford, Northolt and Biggin Hill.

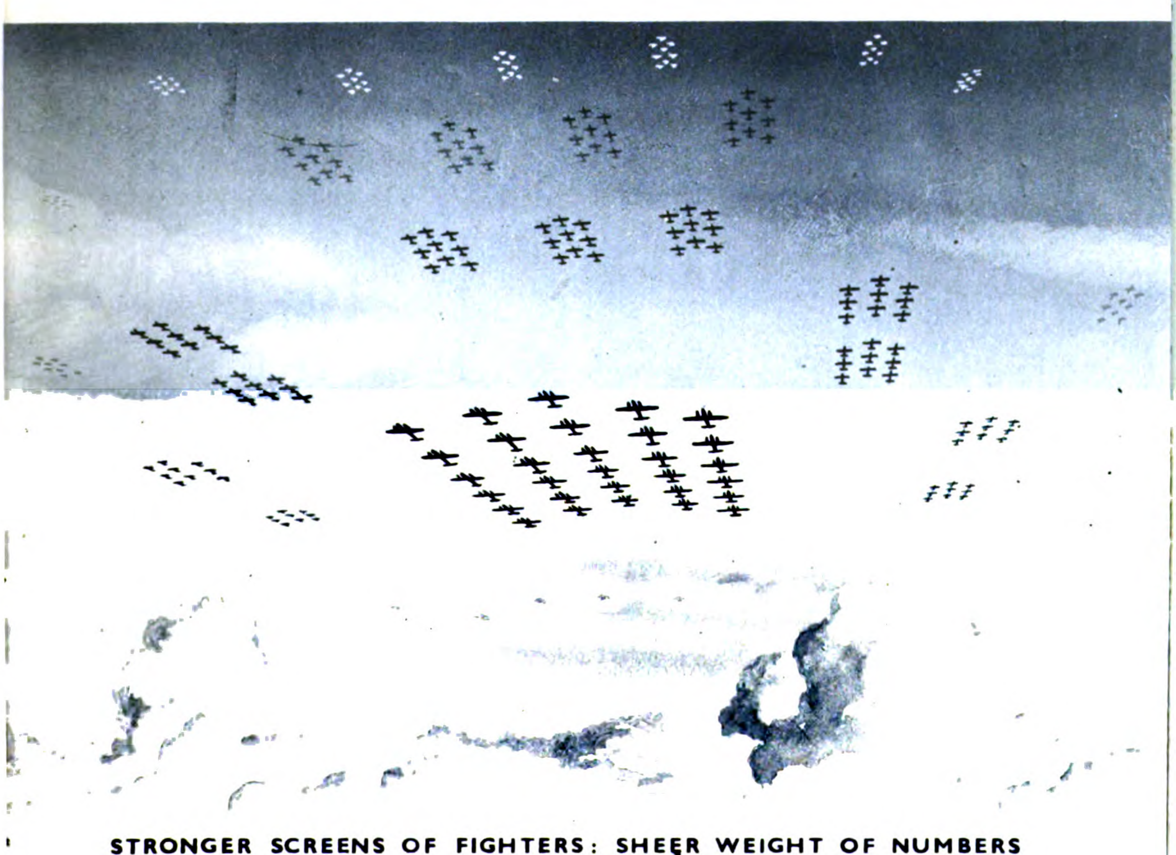
The opening of September showed little, if any, falling off in the assaults of the enemy. There were three heavy attacks on 1st September, five on 2nd, one on 3rd and two on 4th and 5th. One of the attacks on the 2nd got to within ten miles of London, but most of them were once again directed against fighter aerodromes. This was the last of the thirty-five main attacks delivered in this phase. They cost the Germans five hundred and sixty-two aircraft known to have been destroyed. Our own losses were two hundred and nineteen aircraft, but a hundred and thirty-two of their pilots were saved.

During these twelve days, our own tactical dispositions were altered so as to meet the changed form of attack. The effect of this was to cause the enemy to be met in greater strength and farther away from their inland objectives, while such of his aircraft as were successful in eluding this forward defence were dealt with by Squadrons farther in the rear.

The heavy task of the defence can be realised by the fact that in these first two phases of this great battle from the 8th August to 5th September inclusive, no fewer than 4,523 Fighter Patrols of varying strength in aircraft were flown in daylight, an average of one hundred and fifty-six a day.

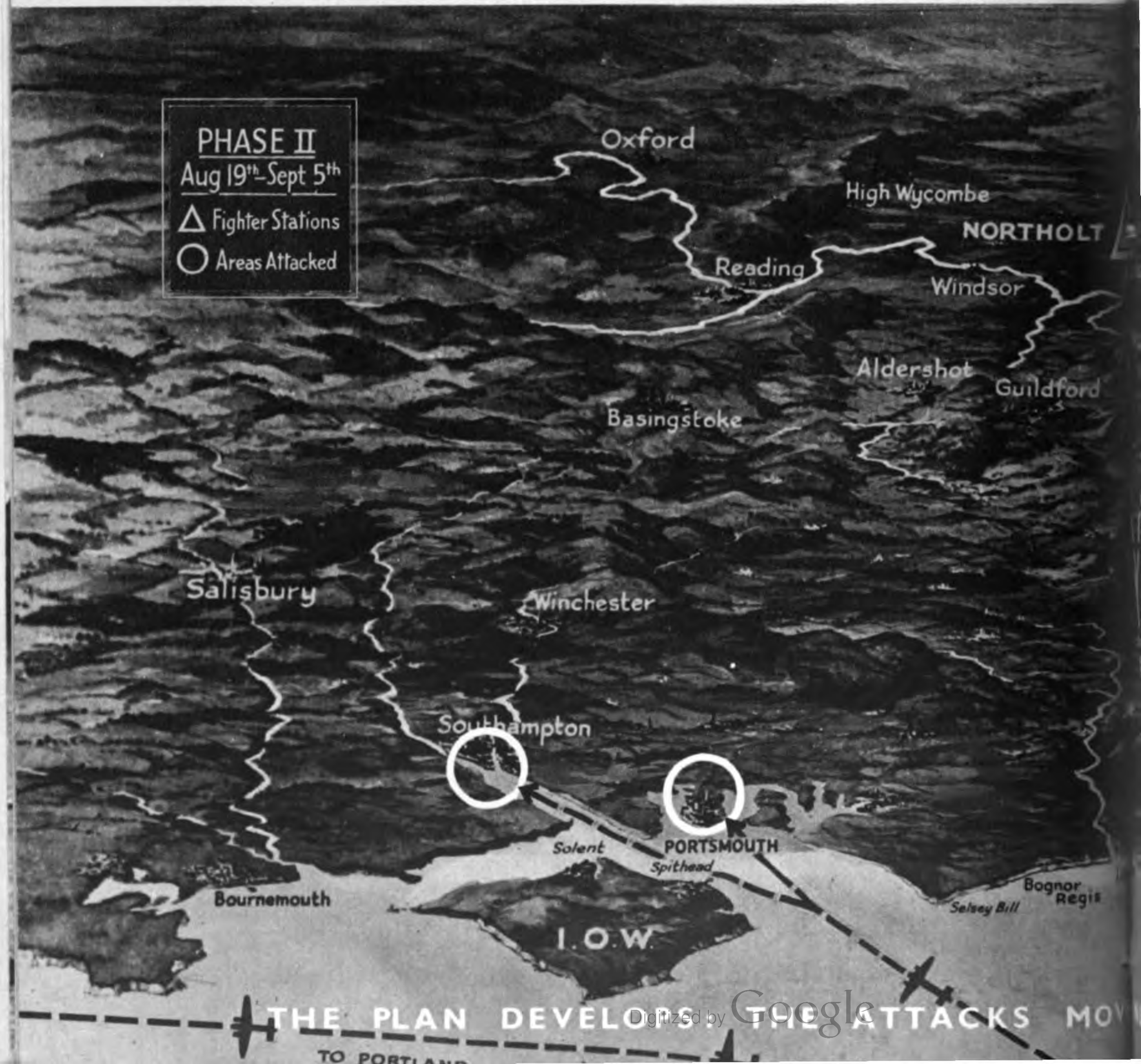
HURRICANES AND SPITFIRES STAY IN THE AIR

What did the enemy succeed in accomplishing in just under a month of heavy fighting during which he flung in squadron after squadron of the Luftwaffe without regard to the cost? His object, be it remembered, was to "ground" the Fighters of the Royal Air Force and to destroy so large a number of pilots and aircraft as to put

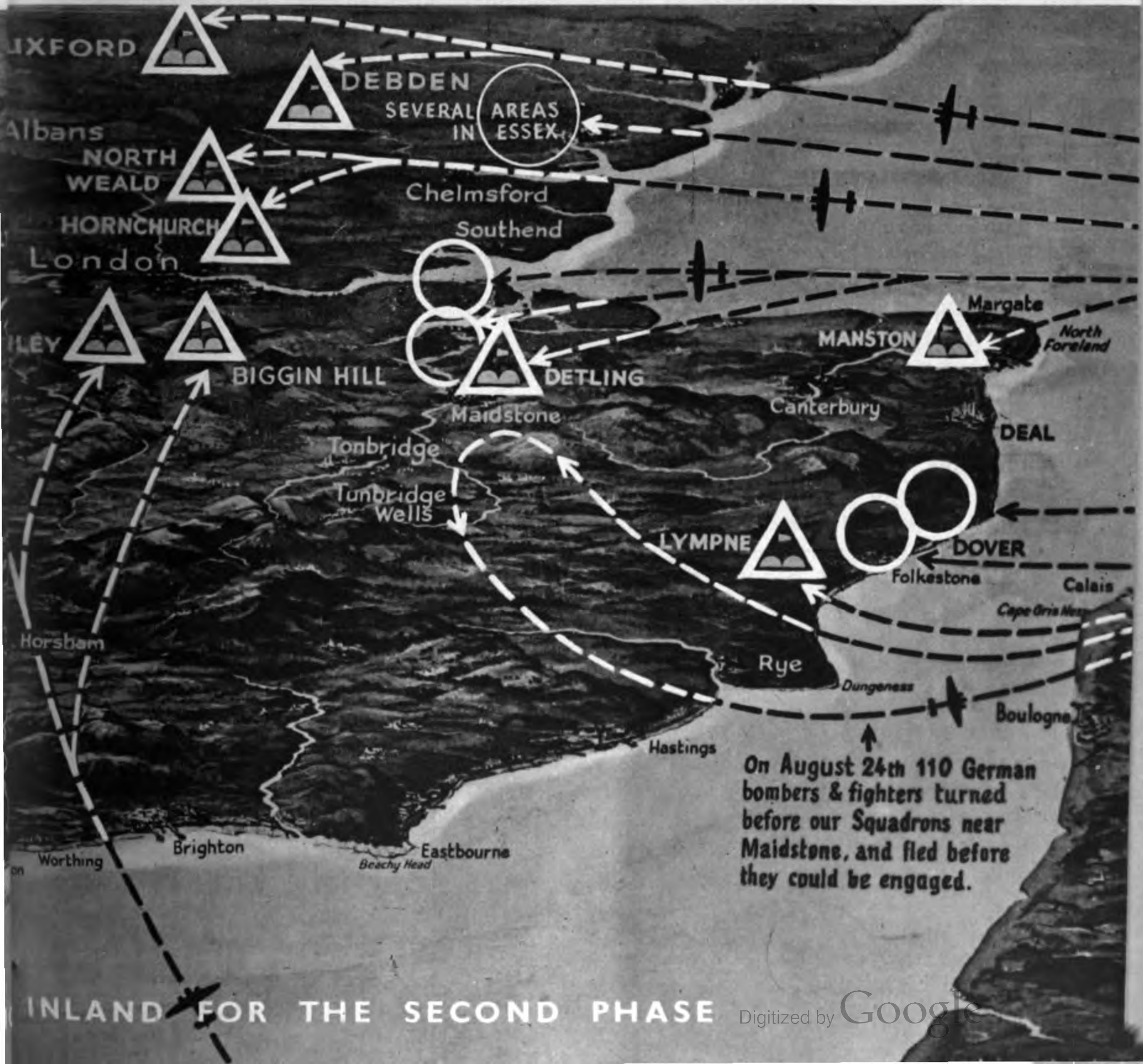


STRONGER SCREENS OF FIGHTERS: SHEER WEIGHT OF NUMBERS it, temporarily, at least, out of action. As has already been made clear, the Germans, after their opening heavy attacks on convoys and on Portsmouth and Portland, concentrated on fighter aerodromes, first on, or near the coast, and then on those farther inland. Though they had done damage to aerodromes both near the coast and inland and thus put the fighting efficiency of the Fighter Squadrons to considerable strain, they failed entirely to put them out of action. The staff and ground services worked day and night, and the operations of our Fighting Squadrons were not in fact interrupted. By the 6th September the Germans either believed that they had achieved success and that it only remained for them to bomb a defenceless London until it surrendered, or, following their prearranged plan, they automatically switched their attack against the capital because the moment had come to do so.

Those days saw the climax of the first half of the battle. As they drew to a close, Göring's position became not unlike that of Marshal Ney at Waterloo, when at 4.30 in the afternoon he flung thirty-seven squadrons of Kellermann's Cuirassiers, backed by the Heavy Cavalry of the Guard against the hard-pressed British squares. Napoleon was unable to find the necessary support and Ney's effort was made in vain. Göring may perhaps have been in the same position,



though the attacks of the Luftwaffe continued to be pressed hard throughout September. It may be that Göring had made up his mind to attack targets more easily reached than were our fighter aerodromes. It may be that he was merely working to a time-table. It may be that he thought that our fighter defence was sufficiently weakened. What probably happened can be conveyed by a simple analogy. Imagine a game which involves knocking down a number of objects such as nine-pins or skittles, in so many turns. The player has worked out a detailed scheme for attacking these by stages. The first two or three shots, however, result in misses, and the prudent man would pause to reconsider his policy at this point. Can he pursue his scheme and still win, or must he abandon it and try another? But this player, Göring, is so certain of winning that he goes on without stopping to think whether or not the preliminary shots have been successful. Suddenly he realises that, with only one or two turns left, he cannot possibly win on the lines of his pre-arranged scheme and he makes a desperate effort to knock down the whole set in the last few shots. This may be no more than a speculation. The facts are that on 7th September Göring switched his attack away from fighter aerodromes on to industrial and other targets, and he began by making London his main objective.



On August 24th 110 German bombers & fighters turned before our Squadrons near Maidstone, and fled before they could be engaged.

INLAND FOR THE SECOND PHASE

PHASE III

London versus Göring

The attacks on London on 7th September were made in two or three distinct waves at intervals of about twenty minutes, the whole attack lasting up to an hour. The waves were composed of formations of from twenty to forty bombers with an equal number of fighters in close escort, additional protection being given by large formations of other fighters flying at a much higher altitude. Most of the German aircraft came over at heights above 15,000 feet in sunny skies which made the task of the Observer Corps very difficult.

At this stage, too, the enemy's dive-bombers reappeared in attacks on coastal objectives and shipping off Essex and Kent. They were a diversion for they came over while the mass attacks by the long-range bombers were in progress. By night the Germans greatly increased their attacks by single aircraft. These made no attempt to hit military targets, but contented themselves with dropping their bombs at random over the large area of London.

All the attacks, however, were in essence the same. Over came the German aircraft in one or more of the many formations already described. Somewhere between the coast and London, usually in the Edenbridge-Tunbridge Wells area, but sometimes nearer to the sea, the German squadrons were met by our fighters. The Spitfires tackled the high-flying fighter screen covering the German attack.

The Hurricanes, which had taken off first, engaged the fighter escort, followed by other squadrons who went for the bombers. There were dog-fights all over Kent. The air was for some minutes—never for very long—vibrant with machine-gun fire. People on the ground have described it as like the sound made by a small boy in the next street when he runs a stick along a stretch of iron railings. As a background there was the faint roar of hundreds of engines which on occasion swelled to a fierce note as some crippled enemy fighter or bomber fell to the ground or made for its base dropping lower and lower with Spitfires or Hurricanes diving upon it. Sometimes watchers, like those upon the keep of Hever Castle, would see the blue field of the sky blossom suddenly with the white flowers of parachutes. The warm sun of those superb September days shone on an ever-increasing number of the wrecked carcases of aircraft bearing on their wings the Black Cross of Prussia or the crooked symbol of Nazi power. So numerous were these that, for a period of over a fortnight, more than two battalions of British infantry from the troops stationed in our Southern Marches were required to guard them.

THE LAST THROW

The attack on London and its environs was the crux of the battle. It continued with little respite from the 7th September until 5th October and was the last desperate attempt to win victory. This could no longer be achieved cheaply, for the Luftwaffe had already suffered terrible losses. But it might still be possible to destroy London and thus to win the war. Despite the hard fighting of the previous month the Fighter defences of the R.A.F. were still fighting as hard as ever. They had to be overcome before London could be placed at Hitler's mercy. Göring still believed in superior numbers. These would win the trick. They had brought him swift victory in Poland, Norway, the Low Countries, Belgium and France; they might still bring victory in Britain. He put forth all his strength in a final endeavour to knock down the nine-pins at any cost. The Luftwaffe delivered thirty-eight major attacks by day between the 6th September and 5th October.

After battering away morning, noon

and night throughout the 6th September against our inland fighter aerodromes, the German Air Force made a tremendous effort on the 7th to reach London and destroy the Docks. Three hundred and fifty bombers and fighters flew in two waves East of Croydon up to the Thames Estuary, some penetrating nearly as far as Cambridge. They were met over Kent and East Surrey, but a number broke through and were engaged over the capital itself. For the first time since that September day in 1666, when Mr. Samuel Pepys informed the King at Whitehall that the City was on fire, Londoners saw flames leaping up from various points in the crowded and densely populated districts of Dockland and Woolwich, while from every German radio station announcers broadcast a running commentary on the action, in which imagination and wishful thinking were nicely blended. London did not emerge unscathed. Damage was inflicted on dock buildings, on several factories, on railway communications, on gas and electricity plants. It was also inflicted on the enemy. One hundred and three German aircraft were destroyed. These heavy casualties shook the German High Command, for though the attacks were renewed and continued, evidently all was no longer well. Still, the Luftwaffe persevered with great tenacity and courage, delivering heavy attacks on 9th September, using on that occasion a number of four-engined bombers; on the 11th, when about thirty aircraft penetrated to Central London; on the 13th and again on the 15th. Those who got through on the 11th were so savagely handled by our fighter defence that the losses among their crews were estimated to be not fewer than two hundred and fifty. On the next day a single German aircraft penetrated the defence by the clever use of cloud cover and bombed Buckingham Palace in the morning. On the 15th September came the climax; five hundred German aircraft, two hundred and fifty in the morning and two hundred and fifty in the afternoon, fought a running fight with our Hurricanes and Spitfires from Hammersmith to Dungeness, from Bow to the coast of France. This engagement will be described in greater detail later. It cost the enemy one hundred and eighty-five aircraft known to have been destroyed. Altogether, between the 6th September and the 5th October, he had lost eight hundred and eighty-three aircraft.

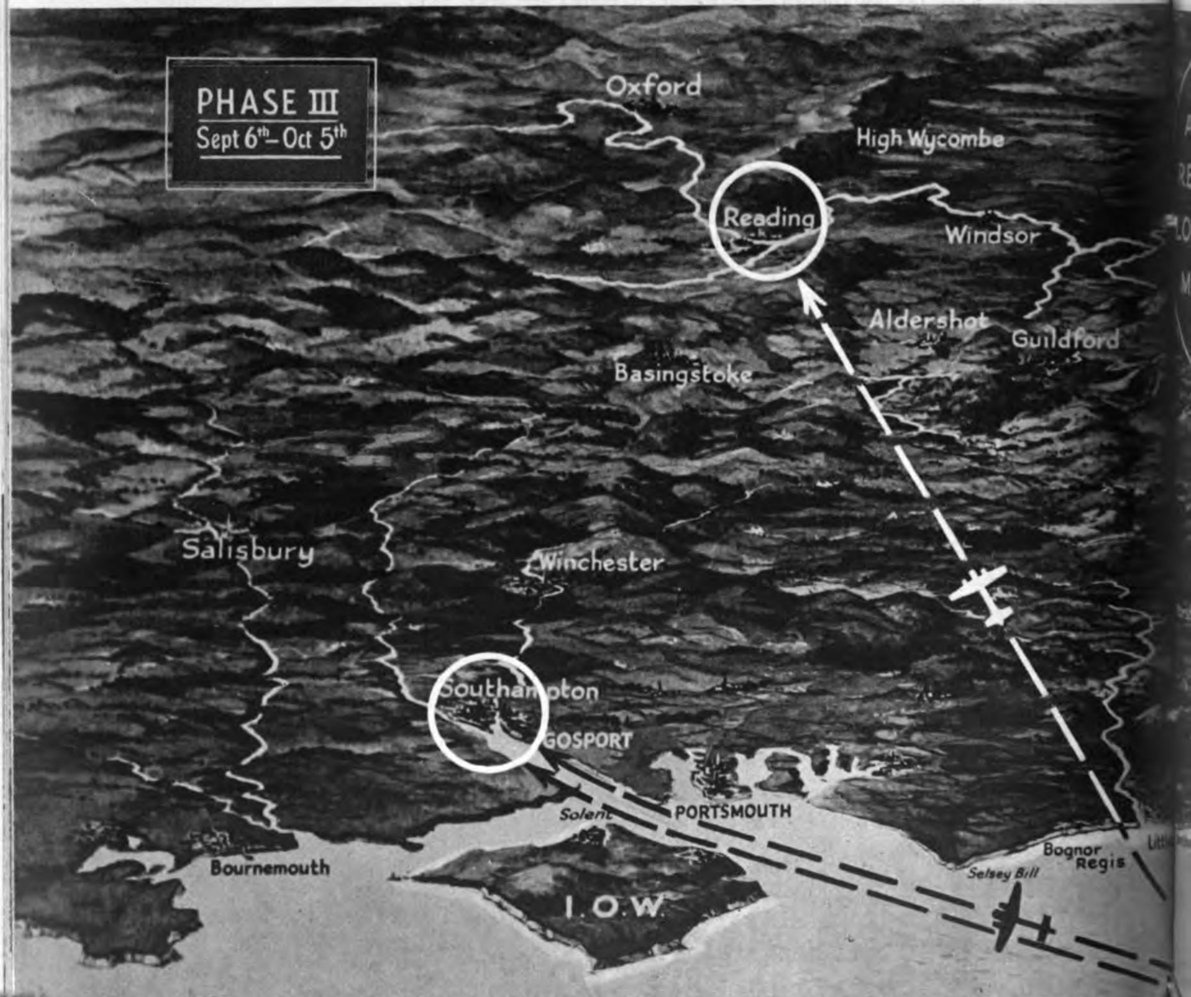
It is not necessary to record in detail the rest of the fighting which endured to 31st October. Enough has been said to show the nature of the German effort and of our defence. There were, however, three more major assaults delivered on 27th September, 30th September and 5th October.

DAMAGE WAS INFLICTED ON DOCK BUILDINGS . . . AND ON THE ENEMY

Thus between 11th September and 5th October the enemy delivered some thirty-two major attacks by day. In all these, bombers were used and their escort of fighters steadily increased in numbers till the ratio rose to four fighters to one bomber. Of these attacks fifteen were made on the area of Greater London, ten against Kent and the Thames Estuary, six on Southampton and one on Reading. While these last attacks were well executed and pressed home, those on London were less determined than in the opening stages of the battle. On many occasions the enemy jettisoned his bombs before reaching his apparent objective as soon as he found himself in contact with our fighters. Throughout this period the bombing attacks were mostly made from high level. To enable their bombers to reach their targets the Germans sought to draw off our fighter patrols by high altitude rather than by geographical diversions. High fighter screens were sent over to occupy our fighters while the bombers closely escorted by more fighters tried to get through some 6,000 to 10,000 feet below.

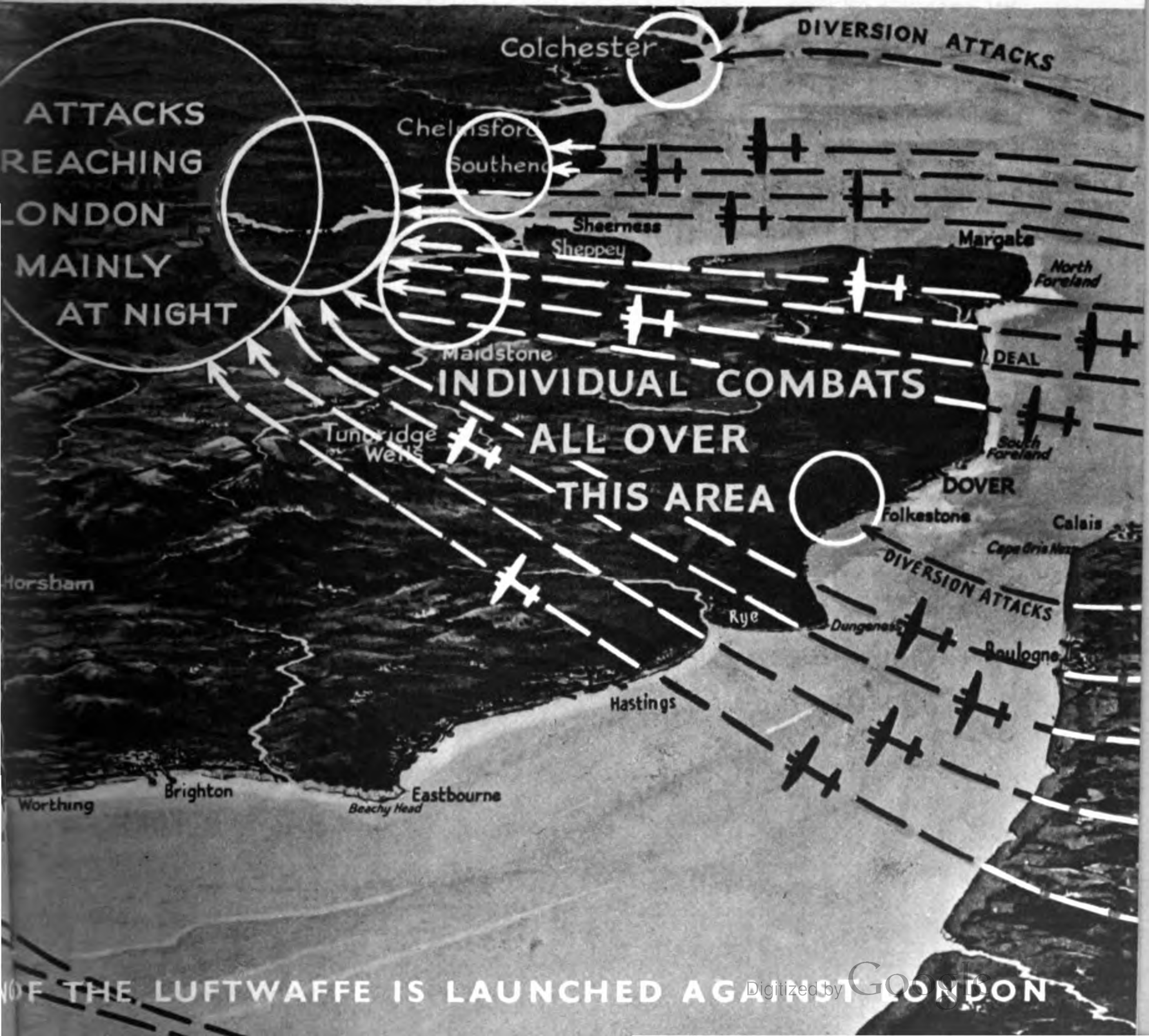
SUCCESS OF BRITISH FIGHTER INTERCEPTION

As autumn came on and the sky grew more cloudy, the enemy began to make increasing use of fighters flying very high above the clouds. His most usual practice was to put a very high screen of these fighters



SEPTEMBER 1940. THE CLIMAX : THE WHOLE STRENGT over Kent from fifteen minutes to three-quarters of an hour before his bombers appeared. The object was evidently to draw off our fighters, exhaust their petrol and thus make it impossible for them to engage the bombers. Sometimes, however, the high-flying enemy fighters appeared only a few minutes before the bombers, which were themselves escorted by other fighters. These escorts were normally divided into two parts, a big formation above and on both flanks or rear of the bombers, and a small formation on the same level as, or slightly in front of, the aircraft they were protecting.

The enemy's high fighter screen was engaged by pairs of Spitfire Squadrons half-way between London and the coast, while wings of two or three Hurricane Squadrons attacked the bombers and their escorts before they reached the fighter aerodromes East and South of London. Other Squadrons formed a third and inner ring patrolling above these aerodromes forming a defensive screen to guard the southern approaches to London. These intercepted the third wave of any attack and mopped up the retreating formations belonging to earlier waves. The success of these tactics may be gauged by the number of casualties inflicted on the Germans. Between 11th September and 5th October, No. 11 Group of Fighter Command alone destroyed four hundred and forty-two enemy aircraft for certain. This was accom-



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How hard fought was the battle can be seen from the fact that from 8th September to 5th October inclusive, 3,291 day patrols of varying strengths were flown, and from 6th October to the last day of that month, 2,786, making a total for these fifty-five days of 6,077.

PHASE IV

The Luftwaffe in Retreat

On 6th October, the fourth and final stage of the battle began. The enemy's strategy and method of attack now changed completely. He withdrew nearly all his long-range bombers and tried to achieve his end by means of fighters and fighter-bombers. This change is the surest proof that he had received such a hammering as to make further use of his depleted bombing force by daylight too costly. He preferred to send it over by night, and this he did in increasing numbers. His tactical handling of his fighters and fighter bombers—a few of them were Me. 110's, but they were mostly Me. 109's fitted with a make-shift bomb carrier enabling them to take a pair of bombs at a speed of about three hundred miles an hour—was this.

Mass fighter formations were sent over at a great height in almost continuous waves to attack London, still the principal target. He doubtless hoped by this means to wear out our fighter defence by forcing it to engage, at much higher altitudes, aircraft which were making the best use possible of high cloud cover. In the early stages he reduced the size of his formations and used flights of from two to nine aircraft. The fighter bombers were protected more and more by Me. 110 fighters. Evidently, however, this new plan did not achieve the success for which he hoped, for in the third week of October he reverted once more to large formations flying at 30,000 feet or higher. To enable them to break through, the Germans continued to use the tactics of diversion. Whenever the weather was good enough waves of fighters appeared almost continuously over the South-East of England. Using the cover these provided, very high-flying fighter bombers made frequent and rapid attacks on the London area. On sighting our fighters, however, they often jettisoned their bombs and made off. They showed, in fact, little tendency to engage, but when they did so they sometimes gained the advantage of surprise owing to the height at which they were flying.

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Our own tactics were immediately altered so successfully that No. 11 Group accounted for one hundred and sixty-seven enemy aircraft in three and a half weeks. The cost to the Group was forty-five pilots. In this phase the number of enemy probably destroyed rose considerably, because the fighting took place so high up that our pilots were unable to see the ultimate fate of many of the German aircraft which fell away after the encounter towards the sea. The physical strain of fighting at heights of 30,000 feet or more proved very severe.

It is possible to detect a feeling of despair in the hearts of the Luftwaffe during this final phase of the struggle. Try as they might, and did, our defences were still not only intact but invulnerable. Occasionally an odd Me. 109 or a small formation broke through and reached London, but the weight of the bombs which they succeeded in dropping was only a fraction of what had been dropped in August and September. Moreover, there was little attempt at precision bombing. There can be no better proof of the enemy's failure than that furnished by the citizens of London. During the early stages, many of them took cover when the sirens sounded. Post Offices, Ministries and Public Departments, large stores—all closed their doors and sent their staffs and any visitors in the building to cover. Very soon, however, it was noticed that most of the noise, at no time to be compared with the nightly barrage which soon became the background of their slumbers, was due to gunfire and not to the explosion of bombs. Trails of white vapour forming fantastic and beautiful patterns in the summer sky were often the only indication that the Luftwaffe was over the capital. These pleased the eye and provided a subject for speculation in the streets and public resorts. Soon, however, even these failed to attract much notice. As the days wore on the Londoner, always confident in the ability of the Royal Air Force to protect him in the hours of daylight, began to take that protection for granted. Except when roof-watchers—the Prime Minister's " Jim Crows "—signalled that danger was imminent, life went on as usual and still does.

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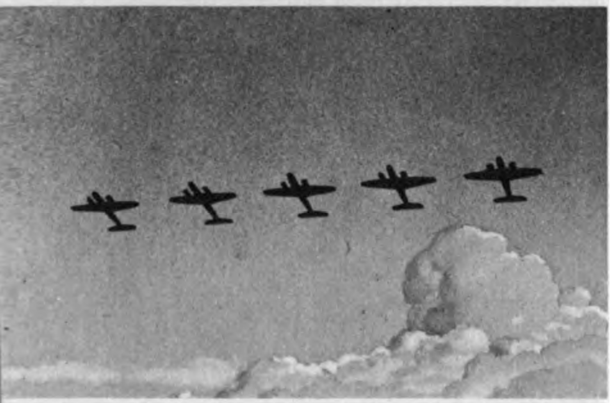


IN VARIOUS FORMATIONS . . .

account of one combat can be taken as typical of the rest.

A pilot, whose Squadron was attacking in echelon starboard, dived out of the sun on to an Me. 109 which blew up after receiving his first burst of fire. By this time he found that another Me. 109 was on his tail. He turned, got it in his sights and set it on fire with several bursts. He was now separated from his comrades and therefore returned to his base. As he was coming down he received a message saying that the enemy were above. He looked up, saw a group of Dorniers at 14,000 feet, climbed and attacked them. He got in a burst at a Dornier; other friendly fighters came up to help. The enemy aircraft crashed into a wood and exploded.

While the Spitfires and Hurricanes were in action over Kent, other Hurricanes were dealing with such of the enemy as had succeeded by sheer force of numbers in breaking through and reaching the outskirts of London. Fourteen Squadrons of Hurricanes, almost immediately reinforced by three more Squadrons of Spitfires, took up this task, all of them coming into action between noon and twenty past. There ensued a continuous and general engagement extending from London to the coast and beyond.

In it the tactics so carefully thought out, so assiduously practised, secured victory. Let a Squadron Leader describe the results they achieved.

"The 15th of September," he says, "dawned bright and clear at Croydon. It never seemed to do anything else during those exciting weeks of August and September. But to us it was just another day. We weren't interested in Hitler's entry into London; most of us were wondering whether we should have time to finish breakfast before the first blitz started. We were lucky.

"It wasn't till 9.30 that the sirens started wailing and the order came through to rendezvous base at 20,000 feet. As we were climbing in a southerly direction at 15,000 feet we saw thirty Heinkels supported by fifty Me. 109's 4,000 above them, and twenty No. 110's to a flank, approaching us from above. We turned and climbed, flying in the same direction as the bombers with the whole Squadron stringed out in echelon to port up sun, so that each man had a view of the enemy.

"'A' flight timed their attack to perfection, coming down sun in a power dive on the enemy's left flank. As each was selecting his own man, the Me. 110 escort roared in to intercept with cannons blazing at 1,000 yards range, but they were two seconds too late—too late to engage our fighters, but just in time to make them hesitate long enough to miss the bomber leader. Two Heinkels heeled out of the formation.

"Meanwhile the Me. 110's had flashed out of sight, leaving the way clear for 'B' flight, as long as the Me. 109's stayed above. 'B' flight leader knew how to bide his time, but just as he was about to launch his attack the Heinkels did the unbelievable thing. They turned south; into the sun; and into him. With his first burst the leader destroyed the leading bomber which blew up with such force that it knocked a wing off the left-hand bomber. A little bank and a burst from his guns sent the right-hand Heinkel out of the formation with smoke pouring out of both engines. Before returning home he knocked down an Me. 109. Four aircraft destroyed for an expenditure of 1,200 rounds was the best justification for our new tactics."

DROPPING EVERY FEW MILES

It must be borne in mind that this great battle was made up of Squadron attacks followed by numbers of personal combats, all taking place more or less at the same time over this wide area. Squadrons flying in pairs or wings of three units went into action in formation against an enemy similarly disposed. After the first attack delivered as often as possible out of the sun, they broke up and individual duels took place all over the sky.

Certain of the more striking incidents may be briefly recorded.

There were the dive attacks carried out by one Squadron of Spitfires which twice passed through an enemy bomber formation, each time delivering beam attacks as they did so. These tactics threw the enemy into extreme confusion. The bombers turned almost blindly, it seemed, aircraft dropping in flames or in uncontrolled dives with every few miles of the return journey. One such aircraft, of which the cowling and cabin top blew off, shed its crew who baled out, all except the rear gunner, who was seen to be hanging from the lower escape hatch until the aircraft dived into a wood, ten miles east of Canterbury.

Then there was the pilot who twice attacked an Me. 109 which each time strove to escape in an almost vertical dive. The first of these from 20,000 feet was successful, for the German pilot straightened out but only to find that the British pilot had followed him down and was close upon him. "By that time," said the British pilot, "I was going faster than the enemy aircraft and I continued firing until I had to pull away to the right to avoid a collision." His burst of fire had taken effect, for the German never recovered, but plunged down until he entered cloud, about 6,000 feet below,

"ACHTUNG, SCHPITFEUER!"

when the British pilot had to recover from the dive as his aircraft was going at approximately four hundred and eighty miles an hour. "I then made my way through the cloud at a reasonable speed," he reported, "and saw the wreckage of the enemy aircraft burning furiously . . . . I climbed up through the cloud and narrowly missed colliding with a Ju. 88 which was on fire and being attacked by numerous Hurricanes."

There was also the Dornier which crashed just outside Victoria Station. Members of its crew landed by parachute on the Kennington Oval while the Hurricane pilot who had shot it down and whose aircraft had gone into an uncontrollable spin when the enemy blew up beneath him, landed safely in Chelsea. Nevertheless, the yellow-nosed squadrons, the élite of the German Air Force, acquitted themselves bravely and showed greater skill than their less well-trained comrades. It was observed that they usually attacked in pairs disposed in line astern some seventy-five yards apart.

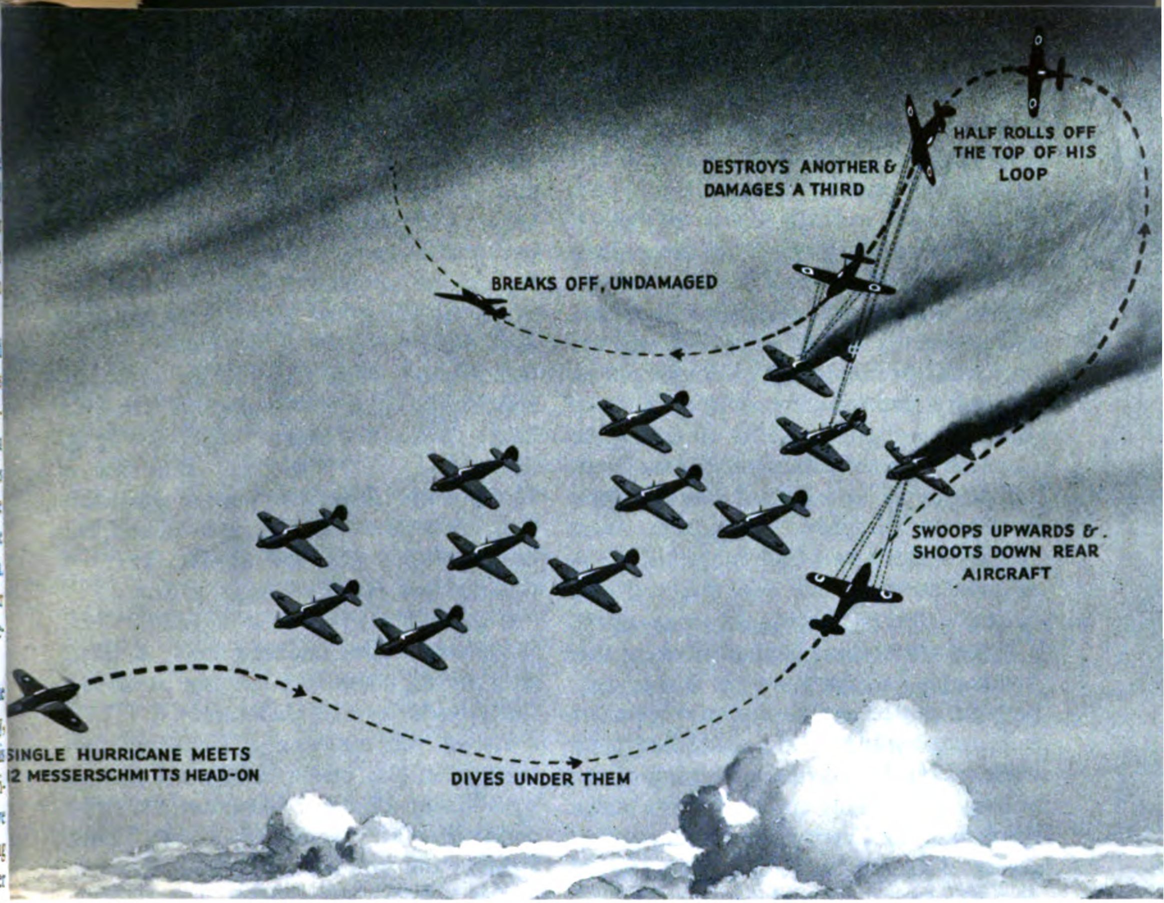
Occasionally, fire at long range proved effective. Close range combat was the rule, but it is recorded that a Hurricane pilot fired at an enemy aircraft moving faster than his own and about to get out of range, and hit it at 800 yards. This caused it to slow up, and his second burst was fired from 500 yards. Eventually he finished it off at 25 yards. Another Hurricane pilot, who had broken off a fight because the cooling system of the engine of his aircraft was giving trouble, and who was therefore returning to base, encountered a lone Me. 109 which he stalked out of the sun and shot down from 500 yards.

At this stage in the fight it became clear that the enemy bomber pilots felt themselves to be no match for the British. It was generally observed that as soon as contact was established, they jettisoned their bombs then broke formation and turned at once for their base. Thus, twenty Dornier 215's were encountered over the London Docks flying in a diamond formation escorted by Me. 109's "stepped up" to 22,000 feet. The bombers were broken up by a level quarter attack and this enabled our intercepting Squadron to pursue them relentlessly and shoot most of them down.

Occasionally in this confused and struggling fight the British Squadrons found themselves temporarily outnumbering the enemy. Thus at 12.15 a mixed force of Hurricanes and Spitfires amounting to the greater part of five Squadrons was over the south of the Thames, somewhere near Hammersmith. Here they encountered an inferior number of the enemy and did terrible execution.

But it was seldom that we had the advantage in numbers. The enemy, however, seemed unable to profit by his numerical superiority. A single Hurricane, for example, encountered twelve yellow-nosed Messerschmitts flying straight at it. The pilot dived under them but swooped upwards and shot down the rear aircraft from directly underneath. As he still had plenty of speed the British pilot half rolled off the top of his loop and followed the enemy formation which had not apparently perceived the fate of their comrade in the rear rank. The British pilot accordingly destroyed another enemy aircraft from the rear and damaged a second before the Germans became aware of what was happening, and he was forced, being still in the numerical inferiority of nine to one, to break off the action.

The fight was all over by 12.30, and by the time the citizens of London and the South-East of England were sitting down to their Sunday dinner the enemy were in full flight to their bases in Northern France. One of those citizens had special cause to rejoice in the result of the fighting. The Prime Minister had spent the morning in one of the Operations Rooms of No. 11 Group. It was observed that for once his cigar remained unlit as he followed the swift changes of


HALF ROLLS OFF THE TOP OF HIS LOOP
DESTROYS ANOTHER & DAMAGES A THIRD
BREAKS OFF, UNDAMAGED
SWOOPS UPWARDS & SHOOTS DOWN REAR AIRCRAFT
SINGLE HURRICANE MEETS
2 MESSERSCHMITTS HEAD-ON
DIVES UNDER THEM

ONE INTO TWELVE . . . LEAVES NINE

the battle depicted on the table map before him.

Some of the enemy had for a brief moment succeeded in penetrating into the centre of the capital but they dropped only a few bombs. The fire was too hot, the defence too strong. Seventy of the estimated two hundred and fifty aircraft in the attack, equalling twenty-eight per cent., were seen to crash that morning, ten more were considered probably to have been destroyed and twenty-eight were observed by our pilots to break off action in a damaged condition. These figures, compiled immediately after the fight and in accordance with the very strict rules applied by the Royal Air Force to pilots' reports, probably underestimate the casualties they inflicted. Even so the Luftwaffe lost slightly over forty-three per cent. of the aircraft used in this morning attack.

SECOND WAVE OF AFTERNOON ATTACKERS

Despite the sound and fury of battle that sunny autumn day, the citizens of London had their Sunday dinner in peace. A lull ensued for about an hour and a half. Then, shortly after 2 p.m., fresh enemy forces returned to the attack in about the same strength as had been employed that morning. German aircraft crossed the coast near Dover in two waves, the first of one hundred and fifty, the second of one hundred. These formations spread over the South-East and South-West of Kent and over Maidstone.

Before they could proceed farther they were intercepted by fighters of the Royal Air Force. Twenty-one Squadrons were sent into the air and twenty-one Squadrons made contact with the enemy. This time the numbers on each side were fairly equal, and the fighting superiority of the

British force was immediately established. Our fighters tore into the enemy's formations, ripping through them like a knife through calico. That was how it sounded from the ground. So determined was the British defence, so effective these tactics, that the German formations were again instantly broken up. This was the opportunity for each pilot to single out an adversary, and in a few moments the sky was again a battlefield. In all that space from the Thames Estuary to Dover, from London to the coast, dog-fights were soon in furious progress. Squadrons were swiftly scattered so that two which took off together from their base might, fifteen minutes later, be fighting fifty miles apart.

There was nothing haphazard about this interception of the enemy. It was only possible on such a scale and in so effective a manner because every detail had been planned and tested in the fighting of the previous months. So, as reports came through of the German approach, we were able to despatch from the correct tactical points enough Squadrons to achieve complete interception and the best results, without dissipating our forces. The general principle applied in coping with earlier assaults having proved so successful it was put into effect in this second great attack. Certain Squadrons were detailed to deal with the enemy screen of high-flying fighters halfway between London and the coast. This enabled the others to attack the bomber formations and their close escort before they reached the line of fighter aerodromes East and South of London. Those of the enemy who succeeded in penetrating these defences—some seventy or so—were tackled by Squadrons of Hurricanes, mostly from Nos. 10 and 12 Groups, who came into action over the capital itself. They also pursued stragglers. As in the morning's fighting some two hundred individual combats took place and, although no two were quite alike, the general pattern was the same.

"I engaged the enemy in formation, causing them to scatter in all directions," ran the report of one pilot. "We sighted a strong formation of enemy aircraft," wrote another, "and carried out a head-on attack. The enemy scattered, jettisoned their bombs and turned for home. We encountered heavy cannon fire...." The reports are laconic: "The whole of the nose, including the pilot's cockpit, was shot away. . . ." "I saw tracer flying past my left wing and saw an Me. 109 attack me. . . ." "I saw his perspex burst and the enemy aircraft spun down. . . ." "I did not consider it worth while to waste any more ammunition upon it. . . ." "I then looked for more trouble and saw an He. 111. I attacked and closed to about 10 feet . . ." "I gave him everything I had. . . ." "Aircraft became uncontrollable. I baled out, coming down with left arm paralysed (afterwards learned dislocated). . ."

As in the morning a single British aircraft, in this case a Hurricane, piloted by a Group Captain, encountered a large formation of German aircraft, both fighters and bombers, and went into the attack alone.

"There were," he said on his return, "no other British fighters in sight, so I made a head-on attack on the first section of the bombers, opening at 600 yards and closing to 200 yards." After describing how all alone he broke up the enemy formation the Group Captain adds, "I made further attacks on the retreating bombers, each attack from climbing beam.... One Dornier left the formation and lost height. With no ammunition left I could not finish it off. I last saw the bomber at 3,000 feet dropping slowly . ."

So it appears that each pilot had his own swift decisions to make, his own problems to meet. He was not found wanting. While the fight lasted the Germans were destroyed at the rate of two aircraft a minute. That afternoon's attack cost them ninety-seven destroyed. In the entire day we lost twenty-five aircraft, but fourteen pilots were saved.

Such was a typical day's fighting in a battle which lasted for nearly three months over the South of England.

"Men Like These"

When the order to begin the assault on these islands was given, the morale of the German air crews was undoubtedly high. The reason was obvious. For years these young German airmen had been "groomed" for victory. They were assured of their own superiority as individuals and their omnipotence as a striking force. Had they not seen in the first weeks of the spring of 1940 the terrible predictions of their leader come to pass? Each country Germany had attacked had fallen before the crushing blows of the Nazi war machine, of which they, the Luftwaffe, formed so vital a part. Now, only the British Empire remained inviolate. As those young airmen had swept across Europe from Poland to the English Channel, so they expected to sweep over Britain, subdue her people and prepare the way for an invading army. Disillusion awaited them. As yet, still flushed with victory, they were to see their comrades spin to earth or sea in flames. Nevertheless, let it be said for the German morale, so near it approached to fanaticism, that it never faltered, even when the Luftwaffe was losing seventy, one hundred and one hundred and fifty aircraft during each period of daylight. Certainly the German pilots showed qualities of courage and tenacity; but these were of little avail against the better quality and still higher courage of the British pilots. Even in their hour of defeat some pilots of the Luftwaffe thought that the invasion of Britain might take place at any time and that, if it had to be postponed, it would be successfully accomplished in the spring of 1941. It was not, then, any faltering on their part that caused the daylight attacks to die away.

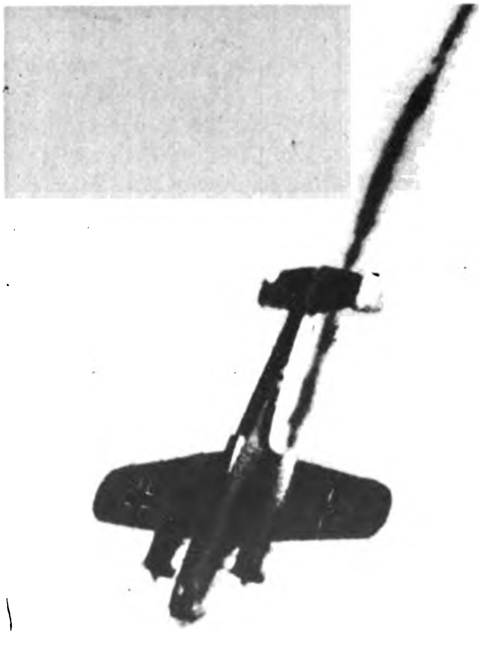
Of the morale of our own pilots little need be said. The facts are eloquent. They had only to see the enemy to engage him immediately. Odds were of no account and were cheerfully accepted. Only a very high degree of confidence in their training, in their aircraft and in their leaders could have enabled them to maintain the spirit of aggressive courage which they invariably displayed. That confidence they possessed to the full.

Polish and Czech pilots took their full share in the battle. They possess great qualities of courage and dash. They are truly formidable fighters.

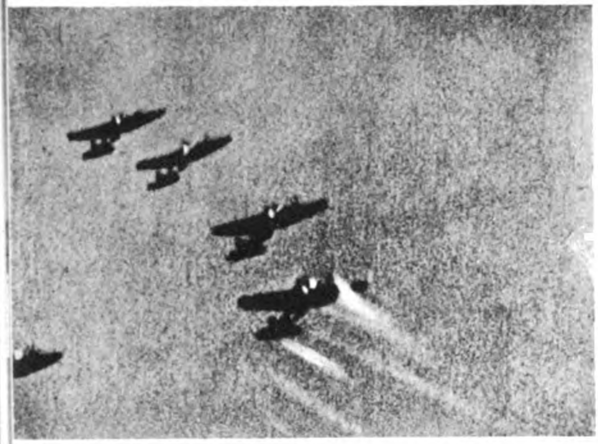
SKY FULL OF SPITFIRES AND HURRICANES

To read the combat reports, written by the pilots immediately after landing from a fight, is to receive the impression of well-trained young men, conscious of their responsibilities and fulfilling them at all times with resolution and high courage.

"Patrolled South of Thames (approximately Gravesend Area) at 25,000 feet," runs the report of one Squadron Leader in action on one of the "great" days. "Saw two squadrons pass underneath us in formation travelling N.W. in purposeful manner. Then saw A.A. bursts,



"THE ENEMY AIRCRAFT SPUN DOWN"



"PORT ENGINE ON FIRE"

so turned Wing and saw enemy aircraft 3,000 feet below to the N.W. Managed perfect approach with two other squadrons between our Hurricanes and sun and enemy aircraft below and down sun. Arrived over enemy aircraft formation of twenty to forty Do. 17's : noticed Me. 109 dive out of sun and warned our Spitfires to look out, Me. 109 broke away and climbed S.E. Was about to attack enemy aircraft which were turning left-handed, i.e., to west and south, when I noticed Spitfires and Hurricanes engaging them. Was compelled to wait for risk of collisions. However, warned wing to watch other friendly fighters and dived down with leading section in formation on to last section of five enemy aircraft. Pilot Officer —— took left-hand Do. 17, I took middle one and Flight Lieutenant —— took the right-hand one which had lost ground on outside of turn. Opened fire at 100 yards in steep dive and saw a large flash behind starboard motor of Dornier as wing caught fire : must have hit petrol pipe or tank; overshot and pulled up steeply. Then carried on and attacked another Do. 17, but had to break away to avoid Spitfire. The sky was then full of Spitfires and Hurricanes queueing up and pushing each other out of the way to get at Dorniers which for once were outnumbered. I squirted at odd Dorniers at close range as they came into my sights, but could not hold them in my sights for fear of collision with other Spitfires and Hurricanes. Saw collision between Spitfire and Do. 17 which wrecked both aeroplanes. Finally ran out of ammunition chasing crippled and smoking Do. 17 into cloud. It was the finest shambles I've been in, since for once we had position, height and numbers. Enemy aircraft were a dirty looking collection."

Men like these saved England.

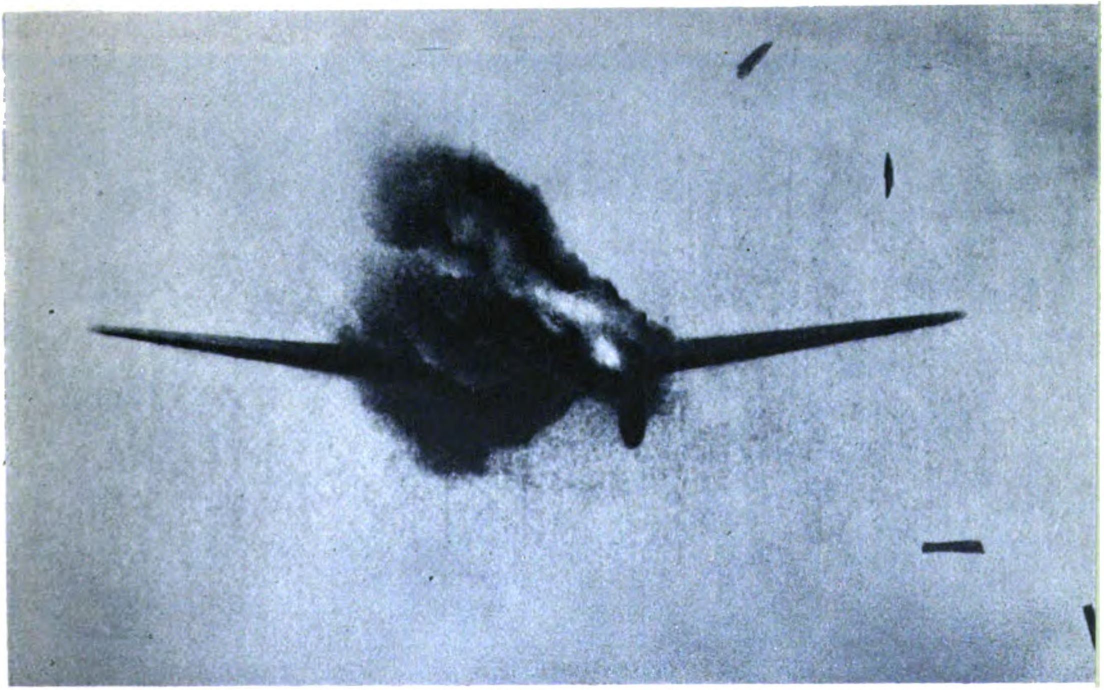
Nor must the ground staffs be forgotten. Their tasks were to "service" the fighting aircraft and to maintain communications at any cost. Those attached to the fighter aerodromes, East, South-East and South of London, fitters, mechanics, signallers, telephone operators, despatch riders and the rest carried on under heavy and sustained bombing by day and by night. For the first time since William of Normandy set foot on these shores, men and women of England—the Women's Auxiliary Air Force was in the thick of it—found themselves in the front line. They did not fail and the list of awards they won bears witness to their bravery and their endurance. They made it possible by carrying out their duties, sleep or no sleep, bombs or no bombs, for the Fighter Squadrons to confront the enemy day after day until he was defeated.

Of the anti-aircraft batteries a whole story can be written ; but this narrative is concerned only with the part played by the Royal Air Force in the victory. Its controllers received most important aid from the A.A. Units. Their shells bursting in black or white puffs against the sky gave to watchers on the ground or in the air invaluable information concerning the whereabouts of the enemy. Moreover, they accounted for nearly two hundred and fifty hostile aircraft in daylight during the period of the struggle.

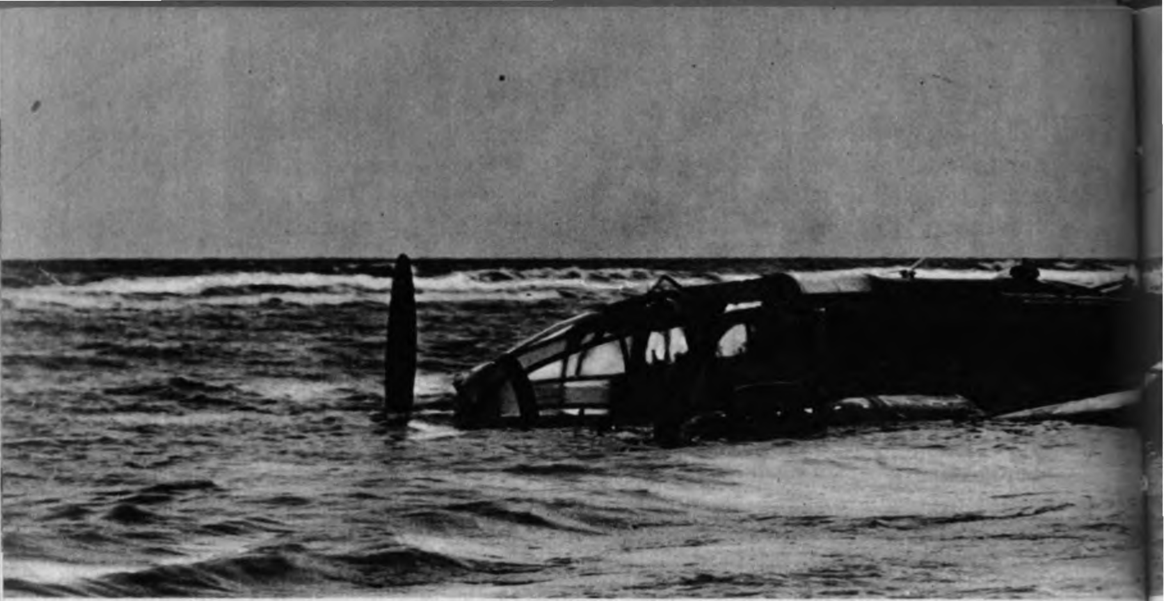
SHATTERED AND DISORDERED ARMADA

By 31st October the battle was over. It did not cease dramatically. It died gradually away; but the British victory was none the less certain and complete. Bitter experience had at last taught the enemy the cost of daylight attacks. He took to the cover of night. For what indeed did the Germans accomplish in all their attacks? At the outset they sank five ships and damaged five more sailing in our Coastal convoys; they next did intermittent and sometimes severe damage to aerodromes; they scored hits on a number of factories which caused production to slow down for a short time. In London they did considerable damage to the Docks and to various famous buildings, including Buckingham Palace. They destroyed or damaged beyond repair some thousands of houses; they killed during the day 1,700 persons, nearly all of them civilians, and seriously wounded 3,360. At night 12,581 persons were killed and 16,965 injured. These heavy casualties occurred during the hours when darkness prevented the enemy from being met and turned back as he was in daylight. They provide a striking, if ominous, proof of the efficiency and devotion of the fighters of the Royal Air Force. To what height would those figures have risen had there been no Hurricanes and Spitfires on the alert from dawn to dusk engaging the enemy whenever he appeared—resolute, ruthless, triumphant?

Such, then, was the measure of the enemy's achievement during eighty-four days of almost continuous attack. A little earlier in the year the Germans had taken thirty-seven days to overrun and utterly to cast down the Kingdoms of the Netherlands and of Belgium and the Republic of France. What the Luftwaffe failed to do was to destroy the Fighter Squadrons of the Royal Air Force which were indeed stronger at the end of the battle than at the beginning. This failure meant defeat—defeat of the German Air Force itself, defeat of a carefully designed strategical plan, defeat of that which Hitler most longed for—the invasion of this Island. The Luftwaffe which, as Goebbels said on the eve of the battle, had "prepared the final conquest of the last enemy—England," did its utmost



"I GAVE HIM EVERYTHING I HAD"



and paid very heavily for the attempt. Between the 8th August and 31st October, 2,375* German aircraft are known to have been destroyed in daylight. This figure takes no account of those lost at night or those, seen by thousands, staggering back to their French bases, wings and fuselage full of holes, ailerons shot away, engines smoking and dripping glycol, undercarriages dangling—the retreating remnants of a shattered and disordered Armada. This melancholy procession of the defeated was to be observed not once but many times during those summer and autumn days of 1940. Truly it was a great deliverance.

It was not achieved without cost. The Royal Air Force lost 375 pilots killed and

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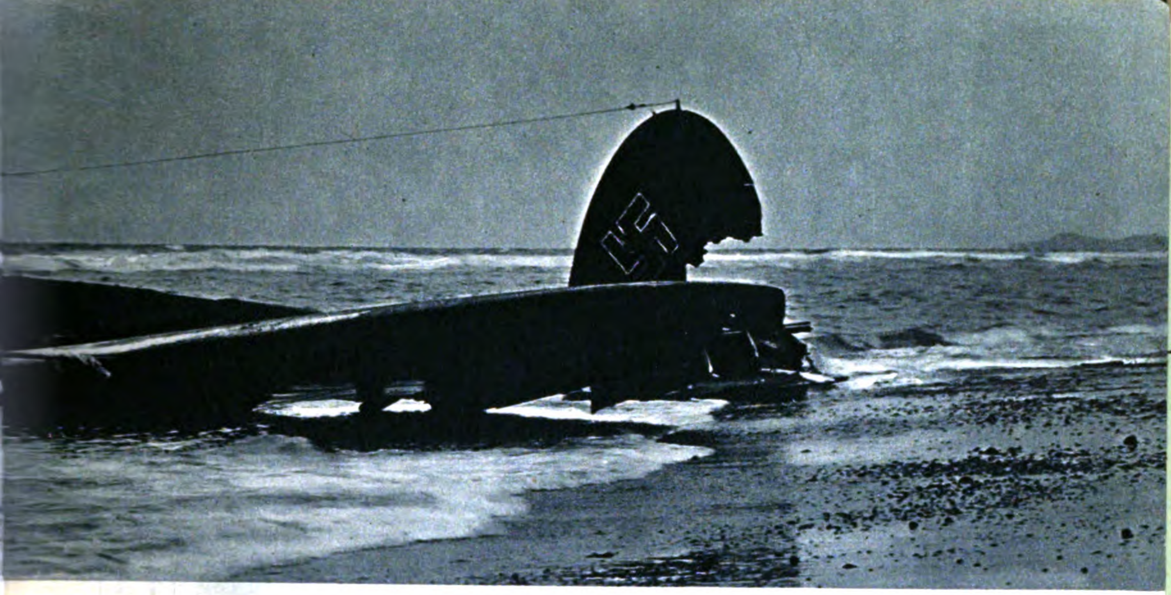
* Throughout this account all figures relating to enemy aircraft concern only those actually destroyed. The number damaged or regarding whose fate complete evidence proved impossible to obtain has not been given.

THE MELANCHOLY REMNANTS OF



358 wounded. This was the price, and of those who died let it be said that:

> "*All the soul*
> *Of man is resolution which expires*
> *Never from valiant men till their last*
> *breath.*"

Such was the Battle of Britain in 1940. Future historians may compare it with Marathon, Trafalgar and the Marne.

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OF THE AIR MINISTRY

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HATTERED AND DISORDERED ARMADA

DEFENSE

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DEFENSE

[Gt. Brit. Ministry of information]

SPECIMEN OF BRITISH WAR
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BRITAIN'S INDUSTRIAL ACHIEVEMENT *behind the* FIGHTING FRONTS

[1944.]

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A PEOPLE WORKING FOR VICTORY

IT IS NATURAL ENOUGH to picture the struggle between the Allies and the Axis as the clash of vast armies, air fleets and navies. But that is by no means the whole picture. A modern battlefield is simply the point of impact of the total fighting strength of the contending forces. The highly mechanised warfare of to-day engages the skill and energy of entire nations. It can only be waged successfully on the battlefields if a people's total industrial, material and manpower resources have first been mobilised behind the fighting fronts. The extent of this mobilisation, therefore, is one measure of a nation's war effort. Judged by this standard, what contribution have the British people been making to the defeat of the Axis Powers ?

The figures are revealing. The total population of Britain considered available for war services—that is, between the ages of 14 and 65—is 33,250,000. This figure includes the medically unfit, and mothers of young children. Of this number 22,500,000 are mobilised in the Army, Air Force or Navy, or are engaged on vital war work. This means that two out of every three adults between 14 and 65 are *directly* assisting the nation's war effort, either in the armed forces or in an essential war industry.

The part played by British women is impressive. The 33,250,000 adults available for mobilisation include 17,250,000 women. But of this number over 10,000,000 are married or occupied in necessary household duties ; such duties, for instance, as looking after the 9,250,000 children in Britain under 14 years of age. None the less, over 7,000,000 women are in the Services or employed full time in essential industries. Britain is the only country in the world which conscripts women for its uniformed Services. And it is probably true that mobilisation of women in Britain is as great as in any other country at war ; available information suggests that it is definitely greater than in Germany.

This picture of full-time employment would not be complete without reference to the many war duties that are either voluntary or unpaid. Most of these are part-time duties, carried out by workers after a full day at the bench or desk. There are, for instance, nearly 2,000,000 Home Guards—Britain's civilian army trained to resist invasion. There are over 5,000,000 trained Fire Guards, both men and women ; and some 750,000 voluntary collectors for the National Savings Campaign. In all, at least 9,000,000 unpaid or voluntary war jobs are done by the workers of Britain—and by far the greater proportion of these demand at least 48 hours a month on duty and are carried out in addition to full-time essential work.

The bare facts of such a mobilisation show that the British people are putting their whole time and energy into the waging of total war. They do not show the spirit in which mobilisation has been accepted, or the sacrifices that have been made by the ordinary man and woman so that the armed forces shall not want for ships, planes, tanks and guns. Even in the face of military losses, of long months of heavy bombing, of news that brought disappointment and sorrow, the British people worked on—always increasing output. Everyone would sooner work in his own home town among the people he knows. Yet, in the interests of industrial output, 5,000,000 British citizens have agreed to live and work in districts far from their own homes. Up to June 1942, nearly 20,000,000 removals between different localities had been recorded. In spite of such upheavals in the lives of a home-loving people, the flow of war supplies grows steadily.

In the fifth year of the struggle, the total output per head of Britain's population is greater than that of any other country at war. It is a considerable achievement—the achievement of a people made single-hearted and invincible by the justice of its cause.

93% OF BRITAIN'S IRON AND STEEL OUTPUT IS DIRECTLY CONSUMED BY THE WAR EFFORT

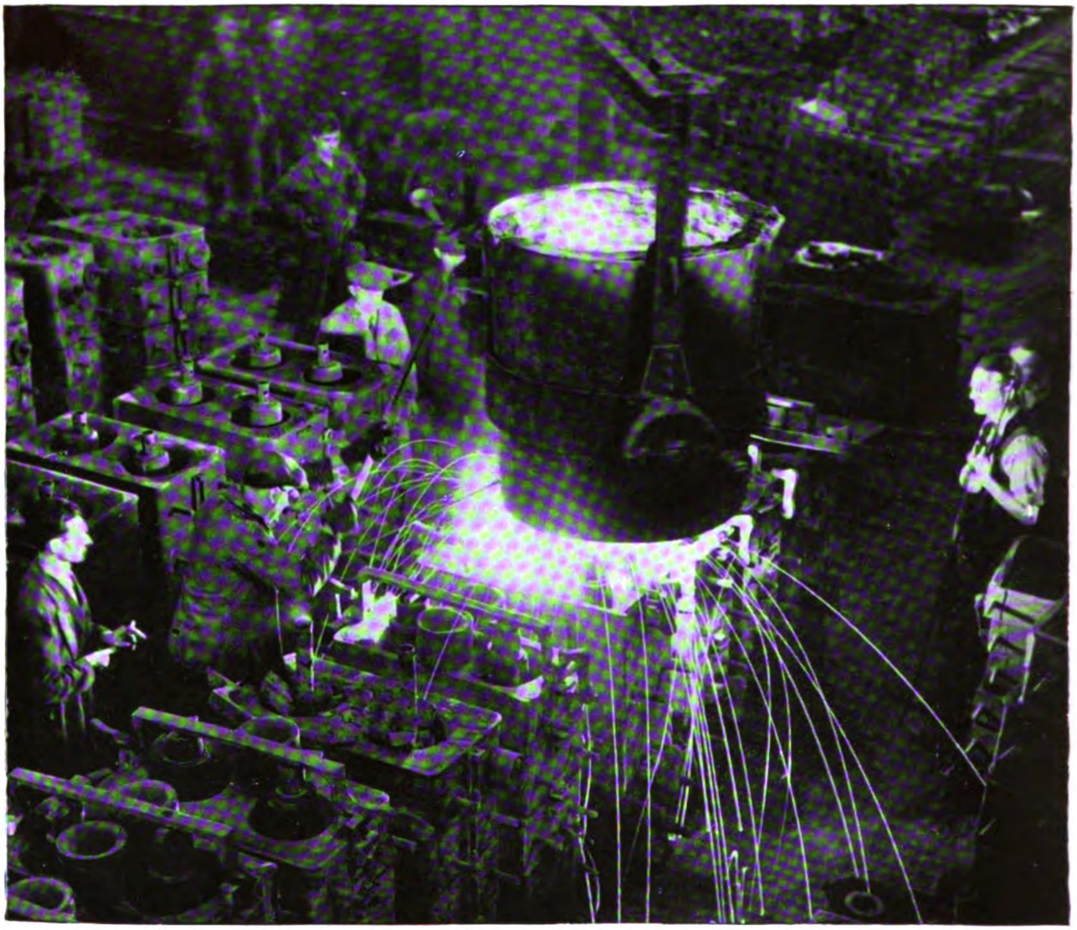
BRITAIN has an old-established and well-organised steel industry and her steelworkers have a traditional skill in the production of steels of every grade and type. It was to be expected, therefore, when the demand came for steel for weapons of war, that the steel industry would meet it. But great difficulties had to be overcome to maintain steel supplies at the high level demanded by Britain's thousands of war factories. The achievements of Britain's steelworkers, steel chemists and metallurgists must rank among the finest efforts of Britain's industrial army. The first great difficulty was the blacking-out of the steelworks so that no glimmer of light escapes when a furnace is tapped or a coking oven is "pushed". Many operations in a steelworks light up the whole sky in peace time. Efficient black-out was essential if vital steelworks were not to become the targets for enemy bombers. Even under the best conditions intense heat makes steelmaking an exacting process for the workers. The closing in and blacking-out of melting shops has thrown a tremendous extra strain on the furnacemen.

The occupation of Norway and the fall of France resulted in the cutting off of the millions of tons of high-grade ore previously imported from Sweden and North Africa. Steel chemists and furnacemen were faced with the problem of producing "melts" suitable for rolling into high-grade steel—but without the raw materials hitherto regarded as indispensable. And this at a time when an ever-increasing tonnage of specially toughened armour-plate was required for tanks and naval ships. But Britain's steel-workers and metallurgists, drawing on a fund of practical knowledge and traditional skill that could only have been accumulated in a hundred years of steelmaking, have managed to produce a greater yearly output of high-grade steel than has ever been rolled before in the history of the British steel industry. Britain has been allowed generous supplies of American bar steel and scrap. But her war factories have had to rely for the greater part on the output of British steel.

A typical British steelworker. He produces, under difficult war-time conditions, the basic raw material of war.

No sooner had the problem of high-grade ore supplies been solved than the British steel industry had to face a further blow. Perhaps the most important type of steel in war time is tool steel—the specially hardened steel used in every war factory. In peace time tool steel contains a high percentage of tungsten, one of the most valuable hardening elements known. And in peace time 88 per cent. of this vital element used by the British steel industry came from Malaya, Burma and the Dutch East Indies. With the loss of these territories to the Japanese, tungsten supplies were cut in a way that threatened the whole tool steel industry. But the steel chemists got to work and found ways of producing tool steels of the requisite quality and hardness from an admixture of molybdenum and as little as 4 to 5 per cent. of tungsten.

Through more than four years of war, British steel experts and steelworkers have had to solve many such problems to keep a river of steel flowing into the war factories. But they have raised steel output above pre-war levels and have nearly trebled the output of high-grade alloy steel needed for armour-plate, ammunition, aircraft engines and cutting tools. Now, 93 per cent. of Britain's iron and steel output is directly consumed by the war effort. The remaining 7 per cent. is used for the minimum of necessary civilian replacements.



Casting bomb-casings on mass-production lines has been organised to keep up the supply of bombs.

Gun barrels for heavy guns at a Government ordnance factory await a final machining.

Thousands of millions of cartridges are produced in the munition factories of Britain every year.

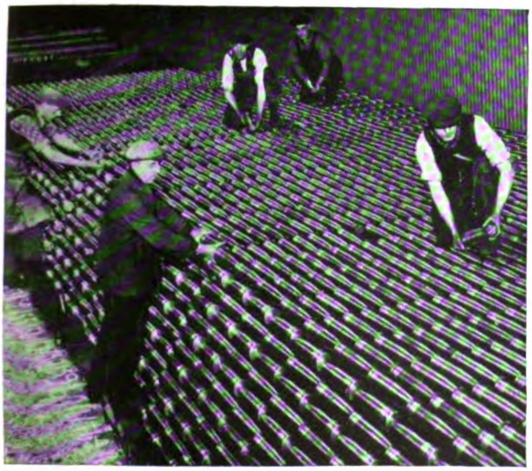
£5,000-WORTH OF MUNITIONS EVERY MINUTE

IN THE GREAT BARRAGE laid down by British artillery at the battle of El Alamein, ammunition was fired at the rate of 1,000 tons every hour—or nearly 100,000 25-lb. shells. In a single air raid on Germany as many as 200,000 incendiary bombs may be showered down. By August 1943, the R.A.F. had raided eighteen of the larger German towns alone over 1,100 times—by early 1944, 3,000 tons of bombs were being dropped in a night.

These figures give some idea of the vast scale on which modern military operations are conducted and the demands that are made on the arsenals of Britain. Highly specialised weapons also need a great variety of ammunition—to-day the Army alone uses more than 250 kinds. Month by month the output of every kind of gun, shell and bullet from Britain's ordnance and armament factories goes on increasing. By August 1942, British ordnance workers were turning out 450 guns for every 100 made in August 1941. Every year twenty-five million rounds of ammunition are produced for guns, two thousand million rounds for small arms. Production of artillery in 1942 was nearly double the 1941 output.

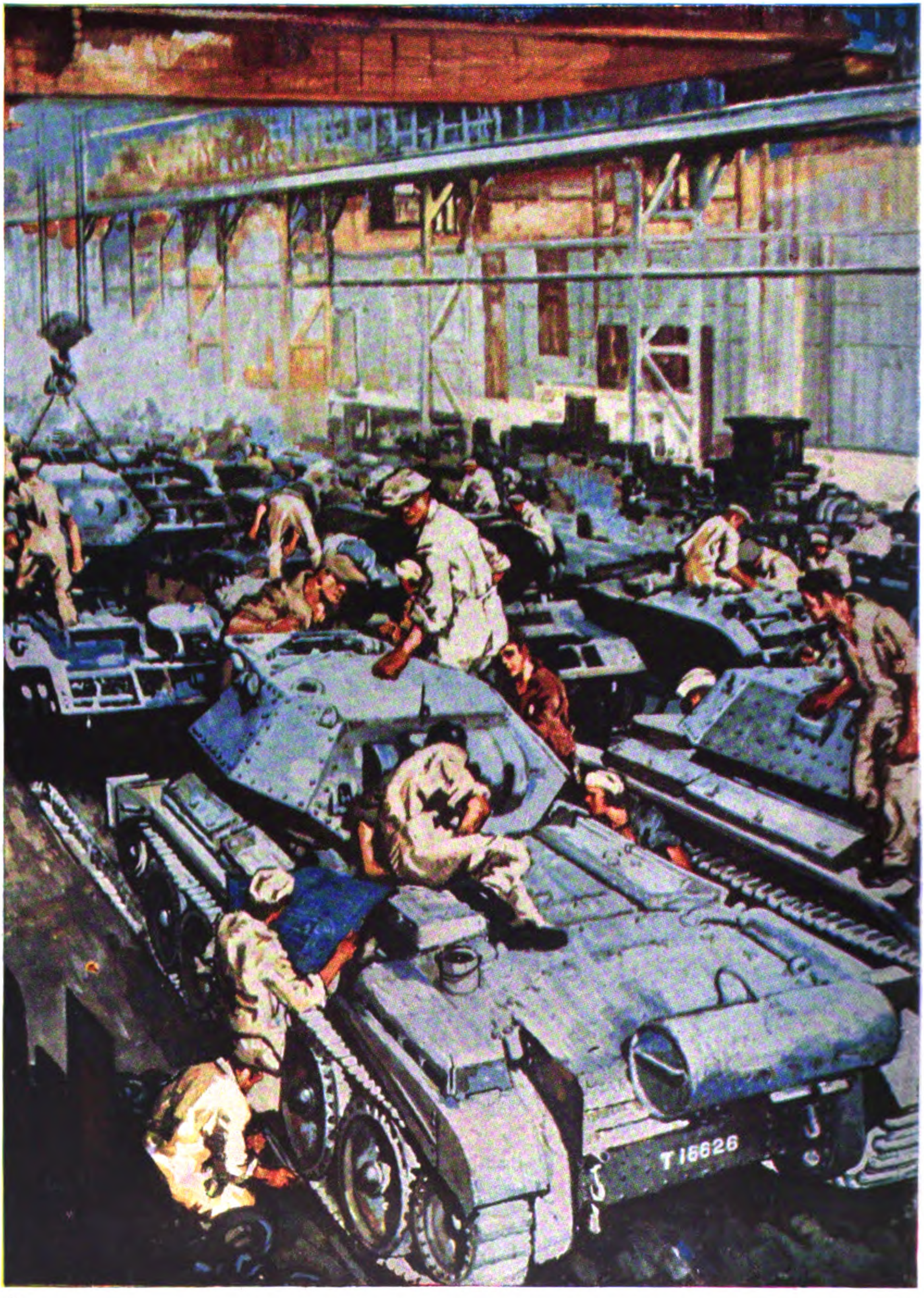
Work in munition factories is heavy, dirty, and often dangerous. Yet the majority of munition workers in Britain are women. Even some ordnance factories making big guns are staffed to over 70 per cent. by women. Few of the women had seen the inside of a factory before the war; now they work 56 hours a week as skilled machine-tool operators. In Royal Ordnance factories only 7½ per cent. of the employees are skilled men with pre-war experience in engineering. By far the greater proportion of the employees, 60 per cent. of whom are women, have had to train themselves for their new job of munition making since the outbreak of war.

But Britain was the cradle of the world's industrial development. Her workers have a tradition of industrial skill that reaches back over two centuries. In that fact, perhaps, is the explanation of the readiness with which her workers, both men and women, can adapt themselves to industrial processes. It is certain that without a great reservoir of labour which could be trained quickly for factory work, she could not have attained a level of war production that is higher per head than any other country. Britain's munitions output alone, from her 30,000 armament works, is now valued at £5,000 every minute. In the time taken to read this page nearly 300 shells and nearly 27,000 bullets are made, tested and packed.



Every minute of the day and night Britain is turning out £5,000-worth of munitions.

Raids on German cities may use over 3,000 tons of output from the bomb factories in one night.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FROM 250 TANKS TO 12,000 IN 24 MONTHS

AT THE TIME of the great air battles of 1940, when every hour threatened Britain with invasion, there were but 200 light tanks armed with machine-guns and fifty infantry tanks in the country. Great losses of heavy equipment had been sustained at Dunkirk. Designs for the new types of heavy tank needed to withstand German fire-power had not yet reached the drawing-boards. Yet within two years Mr. Churchill was able to announce that Britain had 12,000 tanks in the country. In addition, large numbers had been sent to Russia and to the British armies fighting in the Libyan desert. Now, tanks, armoured trucks and other fighting vehicles are streaming from the factories of Britain at the rate of 257,000 a year. The "Valentine" and "Churchill" tanks have already proved fine fighting machines in the snows of Russia and in the sands of the Western Desert.

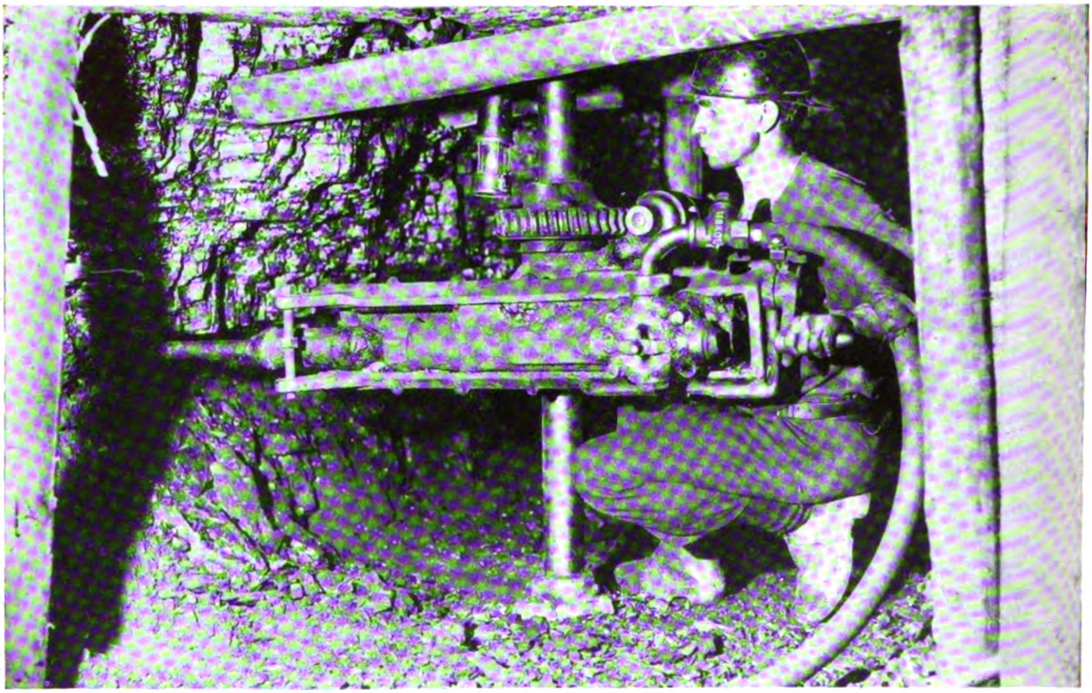
A modern tank contains 8,000 parts. It is one of the most complicated of all war weapons. It is a measure of the adaptability of Britain's engineers and technicians, and the strength of her production resources, that so large a reserve of tanks could be built up so quickly. It could not have been done without the skill and staying power of the British workers who—in 6,000 engineering firms, large and small—got down to the job of building the tanks Britain needed after the disaster of Dunkirk. They worked long hours by day and night, through air raids, week-ends and public holidays. In the heat of July and August 1940, a month after Dunkirk, all production records were broken in the tank factories. Yet in March of 1942, three times as many tanks were being turned out as during the period of the record Dunkirk drive.

At the end of 1943, monthly output had still further increased and tank design had been improved as the result of experience in battle. Fire power was greater, protection better—each tank was a more efficient fighting machine.

Let it be admitted that Britain was ill-prepared for the new type of mobile warfare that startled the world in 1940. Then it must be admitted, also, that design and development of adequate weapons has been carried out with resourcefulness and speed. And the achievement in producing these mobile weapons in quantity, sometimes under the most discouraging circumstances, is a tribute to the self-sacrifice of the workers in Britain's engineering shops.

A large proportion of workers in Britain's tank factories are women. They tackle even the heaviest jobs.

Engineers in a British tank factory at work on the ring on which the revolving turret will rest.



Something like 65 per cent. of the coal mined in Britain is cut and conveyed by machinery.

Miners are front-line troops of the industrial front. British miners at work at the coal face.

A group of British miners leaving the pit shaft ofter a heavy day's work at the coal face.

BRITAIN'S 720,000 MINERS WORK UNDER GREAT DIFFICULTIES

MINERS ARE USED to taking risks and facing danger as a part of their everyday life in the pits. They are toughened by hard work. Their job develops qualities of self-reliance and steadiness in sudden emergencies. For these reasons, the miners make good soldiers. They have a special knowledge and skill, too, that are in great demand in a modern army. Many thousands of miners, therefore, are serving in Britain's armed forces. This has meant that thousands of the youngest and fittest coal-getters in Britain have left the coal face and that the average age of the miner is now higher than it was before the war. But the men who remain have been called on for greater and still greater exertions. Coal has been needed in increasing quantities as Britain's war industries have expanded. And the miners are cutting the coal. In the fifth year of war the miners of Britain, in spite of all difficulties, are making a great contribution to the war effort through their work at the coal face.

The miners of every community are the most politically conscious section of the labour force, very jealous of their hard-won rights and privileges. British miners are no exception. Yet there have been many instances of men volunteering to work longer hours and to give up holiday periods in order that the nation should have more coal. Typical of this self-imposed discipline was the case of seven collieries in Scotland, where some 7,000 miners are employed. The men agreed that the traditional eleven-day fortnight was not enough and voluntarily agreed to put in a full twelve days. In the mining area of Durham, 100,000 men took only a brief week-end rest instead of their annual week's holiday, and in this way hundreds of thousands of extra tons of coal were hewn for the war factories during a period of great emergency.

Another example showing the way in which the older men are putting their backs into their work is the case of thirteen miners in a Yorkshire colliery. The combined ages of these men total 800 years—an average of over sixty—and they have cut between them 8,000 tons in one year.

The strain of war probably falls more heavily on the British miner than on any other member of the civilian community. He cannot get the same food or amount of relaxation he finds so necessary in peace time. Yet the pace of his working day—hard though it is under even the best conditions—must be increased. It is not surprising that industrial disputes have occurred. Yet actual time lost in industrial disputes in the mining industry during the first eight months of 1943 amounted to less than half a day for every miner and the amount of coal lost was less than half of one per cent. of the total raised.

Fuel economies have willingly been made by the individual consumer in Britain. Industrial users have exercised every care to keep down consumption. This has helped. But in the end the country must depend upon the work of the men at the coal face for the coal it so urgently requires.

Britain produces upwards of 227,000,000 tons of coal a year. Coal awaiting delivery to war factories.

BRITAIN HAS DOUBLED THE LABOUR FORCE IN HER SHIPYARDS

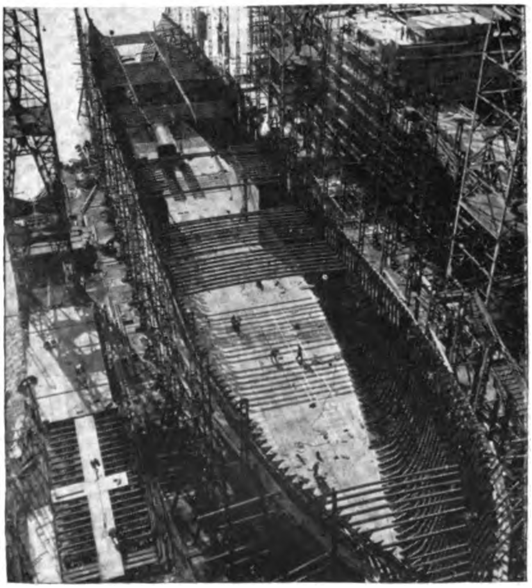
SHIPBUILDING is skilled work. It is not a trade that can easily be mastered. Much of the work calls for a specialised knowledge that cannot be acquired in any other industry. Fortunately, the British shipbuilding industry can call on a large body of skilled workers whose fathers and grandfathers before them spent their lives in the shipyards. But even this considerable body of trained workers was not able to cope with the tremendous war-time demands. Men possessing the specialised skill needed in the shipyards have been called back from other industries. Unskilled workers have been trained to work under the eye of an "old hand". Women in great numbers have been recruited for this difficult and heavy work. By February of 1942, the labour force in the shipyards had been doubled. But this in itself was not sufficient to build the tonnage of naval and merchant ships needed to beat the U-boats. Longer hours had to be worked. More output was needed from each man and woman. The shipyard workers responded. Methods sanctioned by long usage were overhauled, scrapped or modernised—always a difficult matter in an industry with deeply rooted traditions of craftsmanship.

But the British craftsman, designer or engineer, even while he is insisting on good workmanship, can show adaptability and enterprise. And, taking the industry as a whole, despite "diluted" labour and the employment of women on a scale never before thought possible in shipbuilding, the British shipyards are turning out the highest tonnage of shipping per worker in the world.

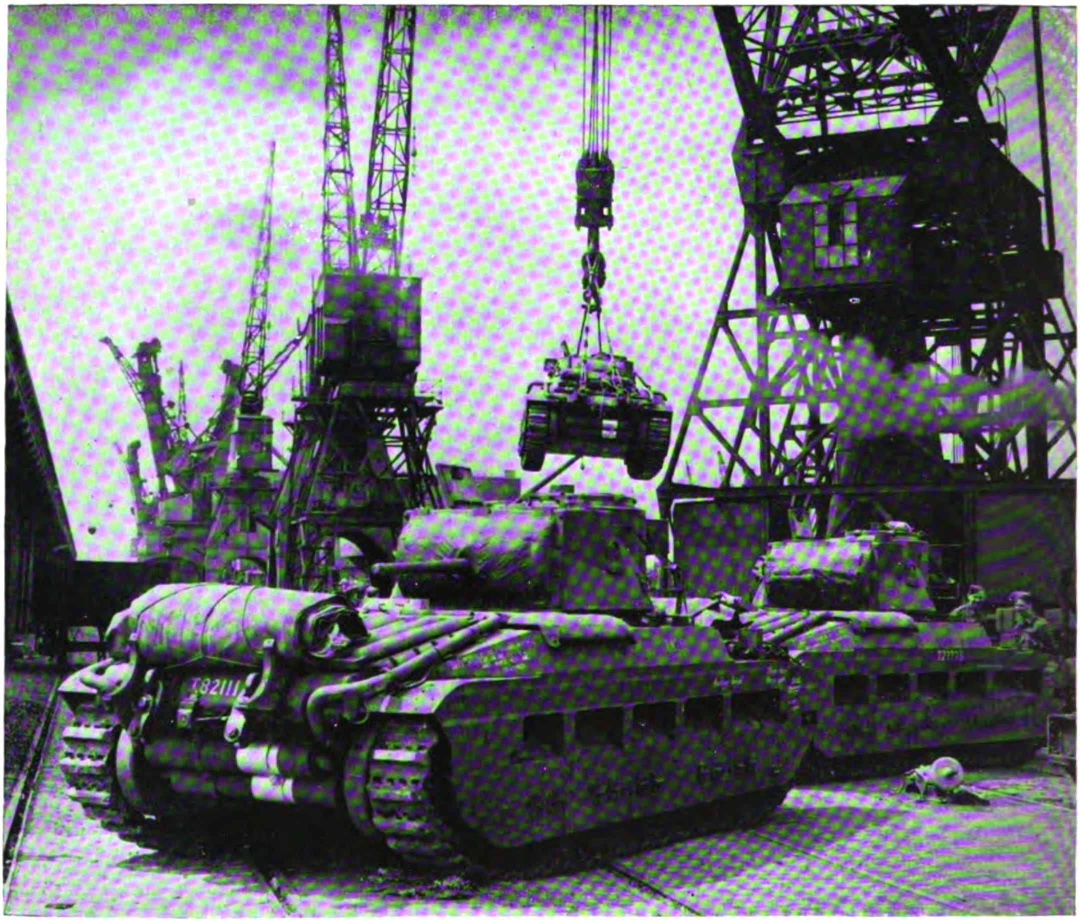
By September 1942, British workers had made good all the losses of capital ships, aircraft carriers, cruisers and destroyers sustained by the Royal Navy in two and a quarter years of sea warfare. By March 1943, over 900 warships, ranging from 35,000-ton battleships to trawlers, had been completed in British shipyards at home and overseas since the outbreak of war.

Repairs, refits and conversions have had to be carried out at the same time as new tonnage was being built. By September 1942, 140,000,000 gross tons of merchant shipping, or 35,000 ships, had been repaired and put back into service. By the end of the same year 34,000 warship repairs and refits had been completed. Many thousands of ships had been converted for the great amphibious operations that have taken place in the Mediterranean. Preparations for the landings in North Africa, for instance, involved alterations to 300 ordinary merchant ships for use as troop carriers, petrol carriers, floating workshops, and many other specialised types. Thousands of assault craft and landing barges had been designed, built and put into operation. Britain's designers produced the now famous 10,000-ton "Liberty" ship that is being built in American shipyards.

For the winning of the Battle of the Atlantic Britain owes her greatest debt to the men of the Merchant Navy and the crews of her naval escort vessels. But the speed with which her shipyard workers have been able to repair damaged ships, and their high rate of output of all types of vessels—particularly escort ships—have also helped to upset Nazi plans in the U-boat war.



The skeleton framework of a large merchant ship rises on the slipway at a British shipyard.


Tanks for overseas battle-fronts must be brought by rail to the ports for loading into the transports.

A British locomotive workshop. 20,000 locomotives are in service on Britain's 20,000 route-miles of railway.

Into Britain's 48 principal ports come raw materials for the war industries and food for the population.

BRITAIN'S TRANSPORT SYSTEM MOVES MILLIONS OF TONS OF MATERIAL EVERY WEEK

THE SWITCH-OVER to a war-time economy in Britain has thrown an additional load on her highly developed transport system. In Britain, there are 180,000 miles of roads, 20,000 route-miles of railway track, and 2,000 miles of canal. To operate this intricate transport network a great army of workers is employed. Britain's four main line railways and the London Transport system employ nearly 650,000 men and women. In addition, there are some 150,000 road vehicles and 6,000 canal barges to be manned. The railways, roads and canals are linked with Britain's forty-eight principal ports and many smaller dock and harbour installations. Into these ports flow the raw materials for Britain's war industries. Out from them go the troops, the war weapons and the supplies for the fighting fronts, all of which are overseas. The dockers of Britain have a vital part to play in the building up of the war production of the country. During the period when shipping losses were nearing the danger point, they reduced the average time taken for the turn-round of ships by two and a half days. The saving of unloading and loading time meant, in effect, that harder work in the docks had presented the country with a million and a half tons of shipping.

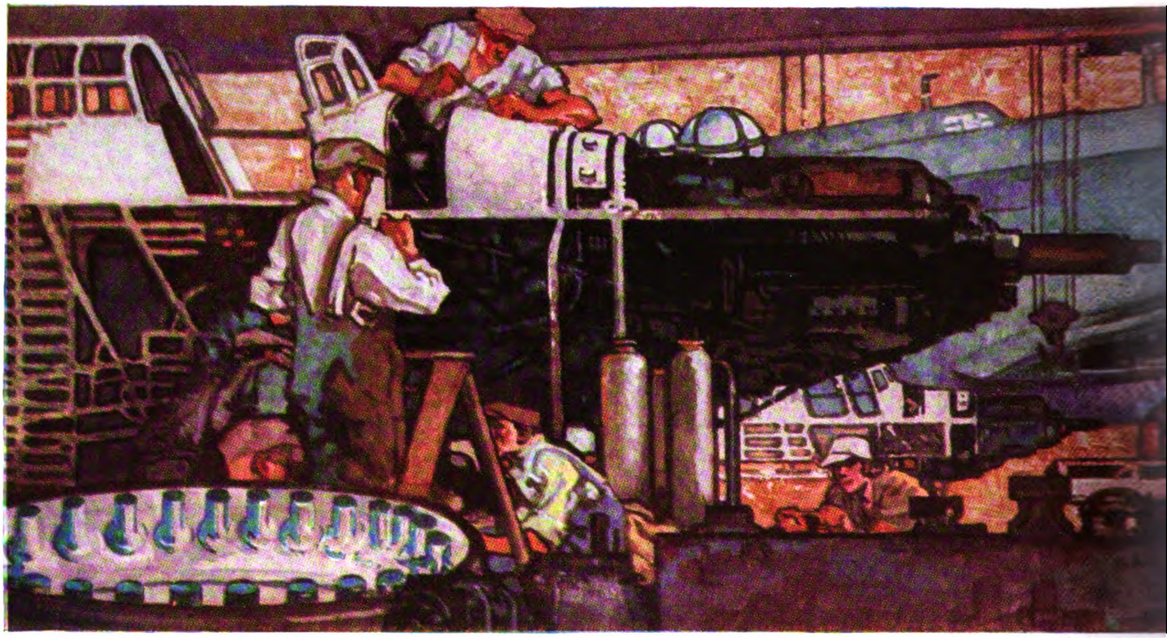
The main task of internal transport falls on the railways. Every week 20,000 freight trains carry the raw materials and the finished products to and from Britain's factories. Seven thousand extra trains a week have to be run for war workers. Every month over 4,000 special troop trains are necessary to deal with troop movements. Coal specials—many of them hauling 1,400 tons at a time—have risen from 27 a week in peace time to 400 a week.

In addition to these everyday demands, the railways must be ready to deal with sudden transport loads. Preparations for the North Africa expedition, for instance, involved running 440 special troop trains, 680 special freight trains, and 15,000 railway wagons by ordinary goods services, to carry men and materials to the embarkation ports.

These emergency calls mean an extra strain on Britain's transport workers. Locomotive men, signalmen, station staffs, gangers and lorry drivers are working long hours and under black-out conditions that are particularly trying because of the nature of their work. They do not complain. They know that every hour of hard work moving up supplies and fighting men for the battle areas helps to bring the day of victory nearer.

Convoys of army lorries are continually passing up and down Britain's 180,000 *miles of roadway.*

Some 150,000 *lorries are on the roads of Britain in peace time. Black-out driving now means harder work.*



BRITAIN ALONE NOW BUILDS MORE AIRCRAFT THAN THE WHOLE OF GERMANY AND GERMAN-OCCUPIED EUROPE

COMPARATIVE STATISTICS of the rate and extent of industrial expansion in war time are not available. But it is probably safe to say that nothing like the expansion of Britain's aircraft industry in the first four years of war has been achieved by any other great Power. As an example, one leading British aircraft firm has increased in size sixty times over. The industry, from being one of relative unimportance, has become the largest in the country. By the end of 1942 it was estimated that Britain was building well over 3,000 aircraft a month. Yet in the Battle of Britain in 1940, British machines were rarely able to fight at odds of less than four to one, and it was not unusual for British pilots to be outnumbered by twenty to one—so outstanding was German numerical superiority. Towards the end of 1943 it was known that Britain was easily outbuilding Germany, who had spent nine years of peace-time preparation in building her air force and, by 1943, had put thirteen years of intensive development into her aircraft industry.

A comparison of the maximum nightly bomb salvo of the German bomber force in 1941 and the R.A.F. in 1943 is instructive. In 1941, the German force, flying the short distance across the Channel from Northern France, dropped 450 tons of bombs in one night on London—the heaviest weight ever discharged on Britain in a concentrated attack. By early 1944, the R.A.F., flying the much greater distances to Berlin, Stuttgart and Frankfurt, was dropping nearly seven times this weight of bombs—3,000 tons—in a single attack.

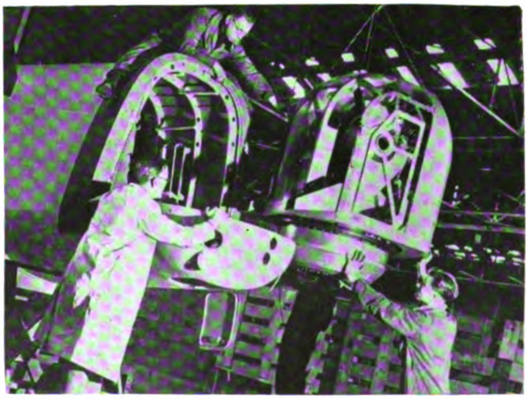
The rapid increase in output of British aircraft has been accomplished in spite of growing complexity of design. The "Lancaster" four-engined bomber, for instance, has 50,000 parts, carries approximately eight tons of bombs, and weighs nearly thirty tons fully loaded. Yet production of heavy bombers was trebled in 1942.

Increased output has been achieved through large-scale recruitment to the industry, the adoption of flow production methods and the stepping-up of the efficiency of each worker.

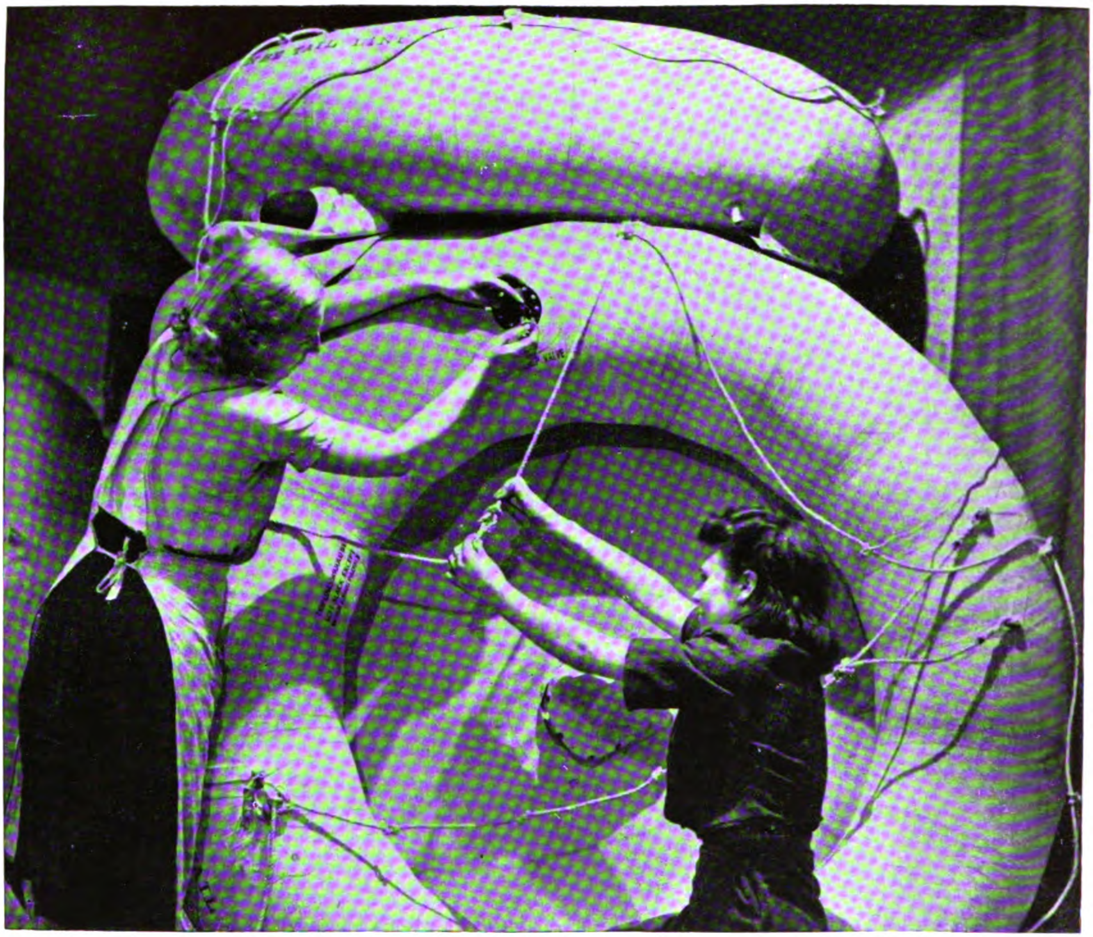
It is estimated, for instance, that over 40 per cent. of the employees in the aircraft industry are women. Improved methods and flow production has cut down the time needed to build a "Lancaster" by two-thirds. In the twelve months ended May 1943, the monthly output of each worker had risen by between 25 and 30 per cent.

The statistical picture of the remarkable growth and achievement of the British aircraft industry gives no hint of the difficulties encountered. The need for dispersal in the face of air attack aimed directly at this one industry; the strain of working through the night with enemy bombers droning overhead; the frequent hold-ups due to temporary shortages of raw materials or through unavoidable changes in specifications. But all difficulties have been met and overcome with cheerful resolution on the part of the workers. They know that air superiority in modern warfare is the key to ultimate victory.

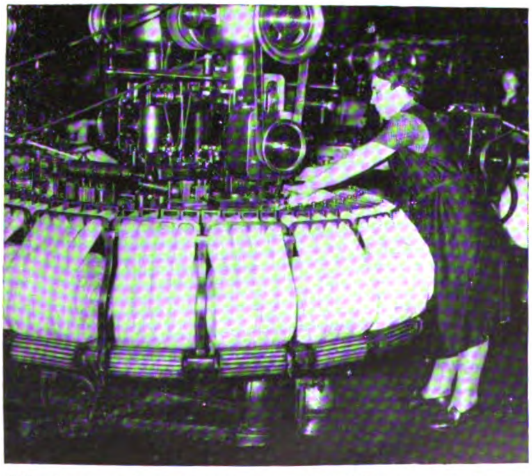
Women are playing a big part in Britain's aircraft industry. Working in the fuselage of a giant bomber.



Lowering into position the tail turret of a "Lancaster" bomber. This must be fitted with great precision.



Hundreds of airmen owe their lives to rubber dinghies. More and more are required as the R.A.F. grows.



Blankets and uniforms for Britain's armed forces take millions of yards of woollen fabrics every year.

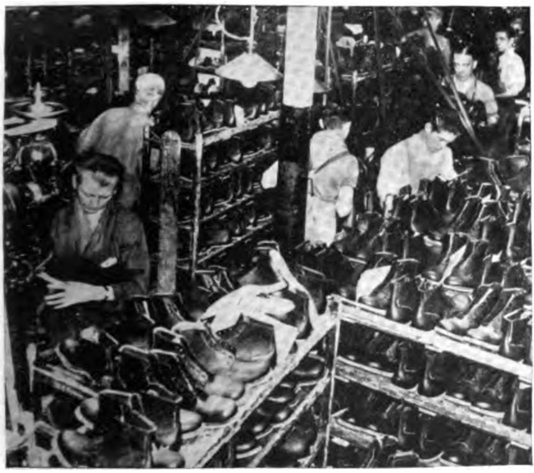
Making a delicate and complicated piece of electrical equipment—an automatic pilot for aircraft.

SEVEN HUNDRED AND FIFTY THOUSAND DIFFERENT CATEGORIES OF ARMY SUPPLIES

IT IS INEVITABLE that war-time demands on industry should be pictured in terms of war weapons and munitions. And it is true that the heaviest burden falls on the coal, steel and engineering industries of a country at war. But armies must be fed, clothed and housed. In total war every industry in the country, almost every separate trade, is drawn into the war effort. It has been roughly estimated that 750,000 different kinds of articles, many of them wanted in millions at a time, must be supplied by Britain's industries to the Army alone. Here are some of the supplies issued to British troops in a single year: 8,500,000 blankets, 3,500,000 ground-sheets, 3,500,000 steel helmets, 20,000,000 pairs of socks, 8,000,000 pairs of boots and 4,000,000 shirts.

But the equipment of her own armed forces has not been the only call on Britain's industrial resources. German successes in Russia during the early days of the invasion resulted in tremendous losses of Russian equipment. Industrial regions were overrun and the Red Army was in need, not only of weapons, but of many everyday articles of clothing and equipment. From Britain's stores a consignment of 3,000,000 yards of greatcoat cloth was baled, packed and dispatched in four days. By April of 1942, 3,000,000 pairs of boots had been shipped for the Red Army. Thousands of tons of medical supplies and equipment have been sent by the northern route to Murmansk and the southern route through Persia. To get these supplies through Persia it was necessary to increase the carrying capacity of Persia's railways. So Britain sent 143 locomotives, 1,600 wagons, and track for the construction of 1,400 miles of railway. It was in the workshops of Britain that this material had to be produced in record time. One group of workers, in ten weeks, built 1,000 trucks—a quantity that would have taken twelve months to build, working to peace-time schedules.

The degree to which industrial production in Britain has been absorbed in the war effort is shown in the case of two industries that would not at first sight be identified with warlike purposes—timber and cotton. No less than 97 per cent. of the total British timber production is used in the war effort—only 3 per cent. is reserved for civilian requirements; the figures for cotton are equally significant; they are 80 per cent. and 20 per cent. respectively.



A British boot factory. The British Army alone uses over 8,000,000 *pairs of boots in a year.*

Pottery kilns. Millions of pieces of crockery are needed for factory and Service canteens yearly.

Since the start of the war wheat acreage alone in Britain had risen 35·6 per cent. by 1942.

Over 6,000,000 additional acres have been ploughed in Britain, increasing arable land by more than 50 per cent.

Britain's agriculture is now the most fully mechanised in Europe. An automatic harvester at work.

BRITAIN GREW 40% OF HER PRE-WAR FOOD: SHE NOW GROWS 70%

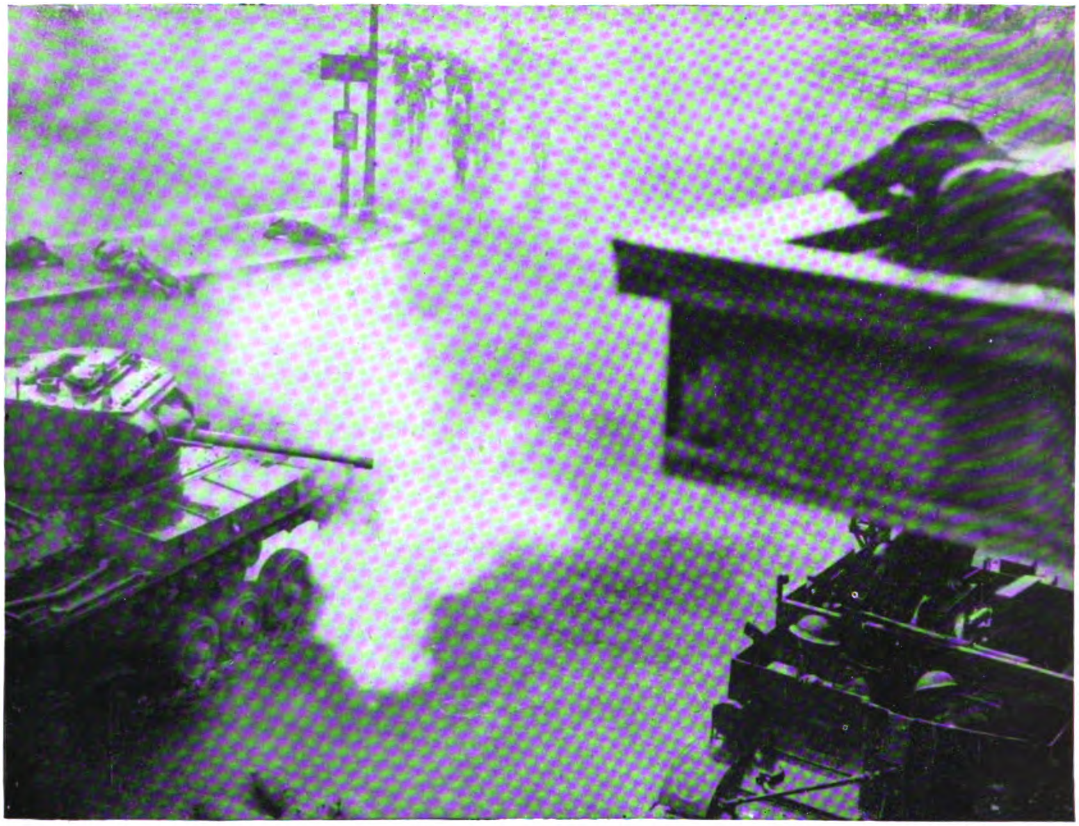
BRITAIN is a small, densely populated country. A very high percentage of this population, even in peace time, is engaged in industry; only 1¾ per cent. work on the land. Before the war, Britain raised only 40 per cent. of her food requirements. Millions of tons of shipping were continually in use bringing in the other 60 per cent. In addition, she imported about 8,500,000 tons of cattle feed every year. But from the outbreak of war every ton of shipping was needed for the transport of raw materials of war and finished weapons, and for the movement of troops and supplies. So the farmers and farm workers of Britain were called upon to grow more food, in order that shipping tonnage could be released. It was a vital war job, and they tackled it with such efficiency and enthusiasm that Britain now grows 70 per cent. of her foodstuffs. Over 6,000,000 additional acres have been brought under the plough, bringing the total of arable land up from nearly 11,000,000 to nearly 17,000,000 acres. The acreage of wheat, oats and other cereals had risen in 1942 by 35·6 per cent., 72 per cent. and 65·7 per cent. respectively since the start of the war. Vegetable production was raised from 2,500,000 tons in 1938 to nearly 4,000,000 tons in 1941. From her increased crops of sugar beet, Britain now refines her own domestic sugar ration. Total milk sales in England and Wales were increased by 40,000,000 gallons in the six months ended September 1942, compared with the same period in 1941. The increased milk production was obtained despite the fact that 50,000 fewer cows were in milk.

A great drainage scheme will result in the reclamation or improvement of about 4,250,000 acres. In the first nine months of this scheme Britain had already achieved more than the Italians in their much-publicised drainage of the Pontine Marshes, which took more than nine years.

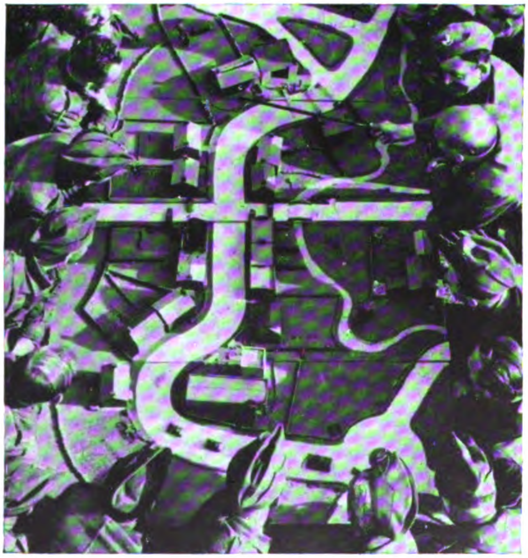
These results have been achieved by the application of improved farming methods, and by a greatly increased degree of mechanisation. Britain is now the most highly mechanised farming country in Europe. Starting with 55,000 tractors at the outbreak of war, it was estimated that 165,000 would be in use by the end of 1943. By the end of 1942, Britain possessed 1,175,000 tractor implements as against 200,000 in 1939. Britain now has more tractors than Germany, although Germany has a far greater area of arable land. British agriculture is now producing nearly three times as much per man unit as the German.

Increases in the amount of farming machinery available would not in itself account for the achievements of British agriculture. The skill of the farmer, the assistance of a Women's Land Army of over 80,000, improved methods developed by intensive research, the formation of organised machinery and tractor pools on which farmers can draw in emergencies, have all played their part. But most important of all has been the sheer hard work and long hours put in by the British agricultural worker, season by season, as one war year lengthened into the next.

There are 1,175,000 *tractor implements on British farms as against* 200,000 *before the war.*



Home Guards take part in a realistic training exercise with Regular paratroops and tanks.



With a model of their village in front of them, Home Guards have a lesson in tactics.

Nearly two million men spend their leisure hours training in the Home Guard for the defence of Britain.

2,000,000 HOME GUARDS AND 5,000,000 FIRE GUARDS—UNPAID

ALTHOUGH BRITAIN'S WORKERS are spending long hours at the bench or desk, their duties do not end when the day's work is over. Every woman from 20 to 45, who works less than 55 hours a week, and every man from 18 to 63, who works less than 60 hours a week, is called upon to do additional service of 48 hours every four weeks in the Civil Defence Services, or as a Home Guard or Fire Guard—all of which is unpaid. This means that, except in cases of special hardship, practically every man up to the age of 63 in the country does about 72 hours a week of national service, and practically every woman up to the age of 45 does up to 67. All additional duties that are undertaken involve a course of special training and repeated exercises. Every town and village in Britain is prepared for air attack. Raids on certain areas of Britain are still of frequent occurrence. Much of the work to be done in saving life and property in night-bombing raids falls on the shoulders of citizens who have put in a full day's work.

For nearly four years now, Britain has stood ready against invasion. And in those four years Britain's Home Guard—a civilian army 2,000,000 strong—has been built up into a disciplined and determined force. Not for a moment is it forgotten that the enemy might even now attempt daring diversionary attacks by airborne troops or even by landings, at a time when Britain's armies were locked in struggle overseas. The defence of Britain would then fall to the Home Guard—and the Home Guard puts in literally millions of man-hours of training every day to be prepared for just such a call. A very large proportion of its equipment, its weapons and its training methods corresponds exactly to those of to-day's British Army itself.

Thousands of other people do part-time duty with Services such as the National Fire Service, the Royal Observer Corps, as Civil Defence Wardens, as members of First-Aid and Ambulance Units, or as Special Police. All these Services have played a part in Britain's war achievement and duties in all of them have meant much tiring day-to-day routine work as well as actual danger.

The additional hours of duty necessitated by membership of these national organisations are obligatory under the law. But the people of Britain accept them willingly. Very few indeed are the prosecutions for neglect of these unpaid, obligatory duties. Britain's citizens were grimly resolved to defend their country in 1940 and 1941, and to hold on until the tide turned. They are no less determined, and there is no slackening in their efforts, now that victory over the Nazi forces is in sight.

At night office workers become Fire Guards and keep a look-out on the roof-tops.

A fire-fighting squad in training. All business premises and factories in Britain have their Fire Guards.

British schoolboys help to grow vegetables in the gardens attached to nearly all British homes.

Boys at the Royal Naval College at Dartmouth receiving technical training in the fitting shops.

At the age of 14 boys can join their school contingent of the Army Cadet Force.

BRITAIN'S YOUTH PLAYS ITS PART IN THE WAR EFFORT

OF THE YOUTH OF BRITAIN between the ages of 14 and 17, 77½ per cent. of the boys and 67½ per cent. of the girls are engaged in war work. Many, of course, are only at the apprenticeship stage. But they constitute a valuable strategic reserve for Britain's industrial army. Some, as they grow older, will take their places in the armed forces. Others will continue their work in industry. At the moment they are making a valuable contribution to the nation's war effort in the factories.

Most boys in Britain are anxious to begin, as early as possible, to fit themselves for one or other of the fighting Services. This they can do through membership of one of the three pre-Service training organisations. These are voluntary organisations which train the boys in their spare time.

The Army Cadet Force gives a military training and members have the opportunity of taking part in manœuvres held with Regular units of the Army. The Army Cadets in Britain now number about 180,000.

The Air Training Corps enrols boys between 15½ and 18, and 181,000 cadets are now members. Most boys in the A.T.C. dream of becoming "Spitfire" pilots and opportunities are given to promising members for actual flying tuition. But many other jobs are of importance to the R.A.F., and boys are encouraged to take a technical training course that will prepare them for work as ground crews.

The Sea Cadet Corps is one of the oldest of all youth organisations in Britain. Even the town-bred lad feels the call of the sea in this country where no town or hamlet is more than seventy miles from the coast. And many of the 350 units carry out their training far inland. But all members look forward to the day when they can volunteer, at the age of 17, for service in the British Navy. About 45,000 boys are training in Britain's Sea Cadet Corps.

The girls can volunteer in the Girls' Training Corps. Here they are able to fit themselves for one of the women's Services, such as the Women's Auxiliary Air Force, the Auxiliary Territorial Service, or the Women's Royal Naval Service. But the training also provides for nursing or clerical work. The present strength is over 97,000.

Thus over half a million of the boys and girls of Britain, besides their work in the war factories, are voluntarily taking some form of preliminary training for service in Britain's forces.

The Air Training Corps—now 181,000 *strong—supplies a steady stream of recruits to the R.A.F.*

Many a town-bred lad in Britain feels the call of the sea. Training for the Merchant Navy.

MR. HERBERT MORRISON,
Home Secretary and Minister of Home Security,
summing up Britain's war effort behind the
fighting front on October 6th, 1943, said:

"Fully 65% of British men and women of military age are directly engaged on war activities. The rest must carry the civilian burdens."

An appreciation of Britain's industrial records over the first four years of war cannot leave out of account the background against which they have been achieved. The necessity of maintaining a strict black-out has affected thousands of factories working twenty-four hours every day, summer and winter alike. Nazi air raids have damaged one out of every five homes in the country. Goods have been in short supply. Substitutes have had to be found for many raw materials. Fair but stringent rationing adds to the daily task of every housewife who has to cater for a hard-working family.

Those who are not directly engaged in war production, those who, in Mr. Morrison's words, "must carry the civilian burdens" have had an important part to play as well. Doctors, nurses, bus conductresses, civil servants, shop assistants, teachers, municipal employees, work long hours under trying conditions to maintain the day-to-day life of the community.

The social services of Britain, for instance, have been fully maintained—and many new ones established. Practically every child under school-leaving age is securing full-time schooling or can be cared for in a nursery. Although nearly 500 hospitals in Britain have been damaged in air raids, over 51,000 beds have been added to the nation's hospital accommodation—a task that, at the peace-time rate of addition, would have taken twelve years. Hundreds of Child Welfare Clinics and War-time Nurseries have been established to care for the health and welfare of the children of war workers. Over three and a half million children are receiving free or cheap milk in schools. About 1,060 Citizens' Advice Bureaux, staffed by 7,000 voluntary workers, give help on every war-time difficulty; in a single year they deal with as many as two and a quarter million enquiries.

The cultural life of the community has not been neglected. Books have never been in greater demand. Cinemas, theatres, concerts, lectures and exhibitions are well attended. The younger people still find time to take part in organised sport—the Englishman's traditional way of combining recreation with healthy, open-air exercise.

But to the visitor from abroad there can be little doubt that the outstanding impression of Britain in war time would be of a people who, though confident of victory, realise that only by hard work behind the lines, as well as by hard fighting in them, can victory be won.

G.P.D. 288/57

[Gt. Brit. Ministry of information]

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A COLONY'S EFFORT

Compiled by

THE NIGERIAN GOVERNMENT

UNIVERSITY OF ...
MAR 11 1946
DOCUMENTS DIVISION

SPECIMEN OF BRITISH WAR LITERATURE SUPPLIED FOR RECORD PURPOSES ONLY

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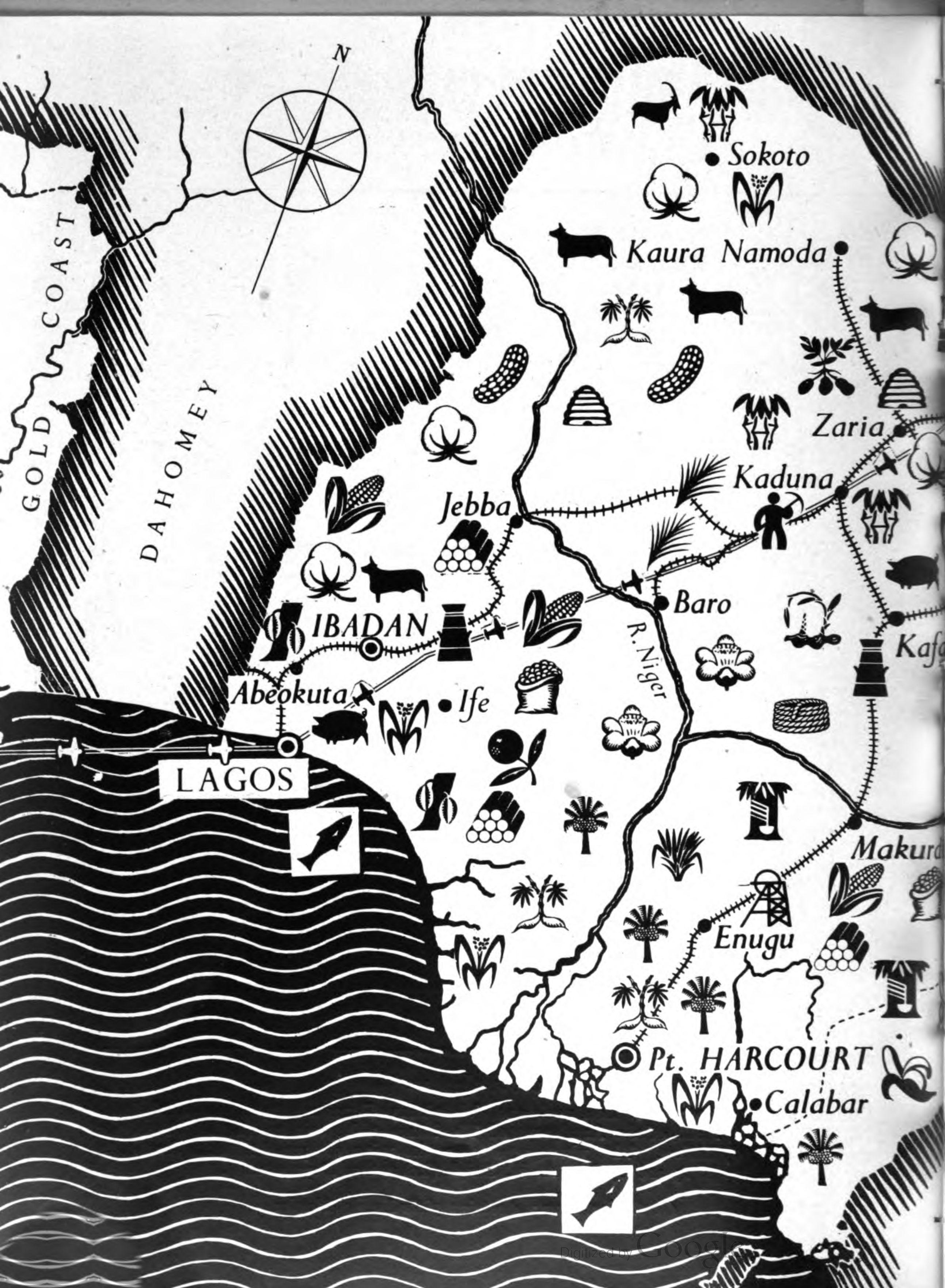
On the front cover: A retainer of the Emir of Katsina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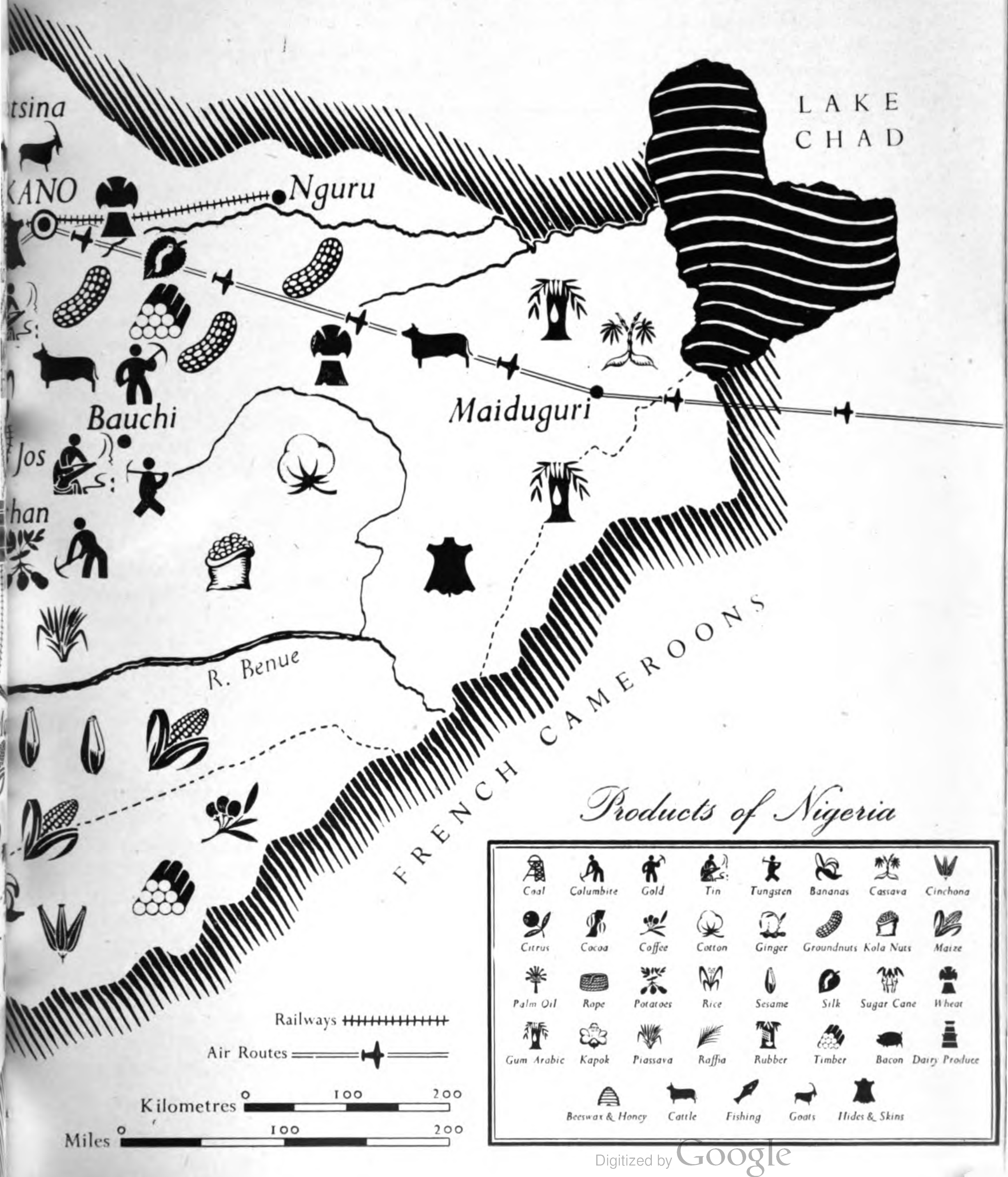
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A COLONY'S EFFORT

Compiled by

THE NIGERIAN GOVERNMENT

Nigeria at War

WHEN ONE meets people outside Nigeria, one is frequently asked "How has the war affected Nigeria?" or "What is Nigeria doing to help in the war?" This little book is an attempt to answer these questions. Some of the information cannot be at present disclosed, but enough can be told to give a good picture of the conditions and of Nigeria's contribution to the war effort.

Nigeria lies like a square-cut ruby at the corner of the Bight of Benin. Including the mandated area of the Cameroons, it covers approximately 373,000 square miles. Thousands of square miles convey little, if anything, but if Nigeria's area is compared with the total area of Belgium, France, Holland and Italy, which it exceeds, it may give some indication. The longest direct journey in the country, from Lagos on the south-west coast to Maiduguri in the north-east, by road and rail, is over 1,100 miles. The rail system extends over 2,000 miles and is supplemented by 20,000 miles of road. In addition to this, there are many hundreds of miles of navigable waterways.

Though the whole country lies within the tropics, there is a great variety of scenery and vegetation in it. The southern edge along the sea is a deep and intricate mass of swamps, intersected by innumerable creeks, which join up as the Delta of the River Niger. It is possible to go by launch from the extreme west of the country to a point near the Cameroon Mountain without going out to sea. North of this lies the high forest belt, where one can travel by the hour without coming out of trees. Then the country rises and the vegetation diminishes and becomes thin and stunted. North of this again it drops into the valleys of the Niger and Benue Rivers. In the area north of these rivers there is a huge extent of land at about 2,000 ft. above sea-level, rising to heights, around Jos, of over 5,000 ft. On these uplands fine trees stand alone in open country—a beautiful country of great distances and of steep hills of grey granite. Goats and cattle feed beneath the trees, and small clusters of native huts are dotted here and there. Along the northern frontier one is near the desert, where thorn trees are the commonest vegetation. There is sand in most places, water being far below the surface.

In this varied country is a population, as now estimated, of about 22,000,000 Africans of dozens of different tribes, speaking dozens of different languages. These people are intrinsically law-abiding and industrious farmers and traders. Many of them are skilled craftsmen and workmen in their own style and are readily trained to European standards.

The development of the country appears to have been slow, but British control and guidance have not been felt all over the country for long, and the Administration has been feeling its way. The coast has been known to Europeans for some hundreds of years, but the type of European who came out was not the kind to assist in any improvement or development. It is safe to say that, over the greater part of the country, there was no substantial attempt at pacification before the beginning of this century. In the north, the Government was only instituted on January 1, 1900, and it was some years before the slave trade, the real reason for the occupation, was finally suppressed in all parts.

The war of 1914-18 found Nigeria in an undeveloped state, and though produce was exported and troops were raised, the effort of the country was not on a scale to be compared with its present effort. The Nigerian Regiment was expanded and supplied troops for the conquest of the Cameroons and, later on, of German East Africa (Tanganyika).

The position is very different now. The country is more highly organised, communications have been developed, and the great wealth of produce so made available has been at the disposal of the United Nations. How this produce has been used will be told in its own section. Before the war, a considerable volume of European products was imported into Nigeria. To save shipping space and to economise in labour in Great Britain, substitutes have been found for many of these imported items, and strict economy has reduced the volume of those necessities for which there are no substitutes. The geographical position of the country in respect to the theatres of war also made it of sudden, unexpected, and possibly even of decisive importance in the chain of communication. These again are tales to be told.

To make it all more difficult the country had been drained of numbers of its administrative and technical staff to provide officers for the expanded Nigeria Regiment. Those that remained had to work at great pressure for long tours of service with only short leaves and all the worry about their families at home that delayed communications automatically brought.

Production

MOST OF THE PRODUCTS of Nigeria used for the war effort are natural products sent to Great Britain in a raw or semi-raw state. Some of these products were exported in peace time, but others are new developments directly due to the war and to the occupation of areas in the Far East.

VEGETABLE OILS

Most of Nigeria's wealth comes from vegetable oils. There are two kinds, and they are entirely different from each other. Palm oil is the product of the hot, moist areas of the south, while the groundnut oil comes from the more arid, semi-desert north. The oil palm is common along the whole of the West African coast, and the groundnut along the southern fringes of the Sahara from the Atlantic to Lake Chad.

The oil palm grows where there is a high rainfall ; its growth is slow, the palm taking 120 years to grow 60 ft. in height. In the forests it grows to greater heights, seeking the sunlight. The palm kernels grow in thick, spiky bunches—big clusters weighing 30 to 40 lb.—at the root of the springing leaves at the top of the palm tree. When they are ripe they are a brilliant flame colour, deepening to red at the base. Most of the trees are wild and uncultivated, except for clearing round the roots, but all the trees have owners, and no one else can touch them. The " heads " of palm kernels are gathered from the forest and taken in as head loads, or often as bicycle loads, to the villages. Then by a simple process the oil is extracted from the fleshy outside, the brilliantly coloured part. This is a scarlet heavy oil which is largely used by Africans in the cooking of food. It is extremely rich in vitamins and its consumption in the old days is said to have counteracted the enormous quantities of spirits drunk by the Europeans who then traded along the coast.

After this process, the internal " nut " is revealed. This is a small, black, hard-shelled object which would just about fit into an ordinary thimble. When cracked, a white flesh is exposed—not unlike coconut flesh—from which a very fine oil is produced.

What does all this do to help in the war effort? The heavy oil is used for a great many purposes in the production of munitions and explosives, apart from ordinary lubrication. A great deal of it goes to the making of soap, and from it is produced a considerable quantity of glycerine, which is essential for war. From the kernel the principal product is margarine.

Preparing palm kernels is a household industry which requires few tools, and scarcely any equipment beyond an open fire and an earthenware pot. The nuts themselves are cracked by hand for the most part, though there is machinery for this. The kernels are boiled and the oil is squeezed by human pressure from the outside of the nut. There were presses of various kinds on the market, but prices were too high for the villager, and during the war they have been very difficult to obtain. This rich oil, and the kernels, are collected in petrol tins and are carried for many miles through the forests to the main collecting centres. In the Eastern Province, bicycles are used as a means of transport to a fantastic extent. They have specially large carriers behind the saddle, and sometimes it is impossible to see the rider for his load.

There is enormous competition in all the villages in the cracking of the nuts and preparation of the kernels, and records are achieved by what would be considered small, backward villages. Little schools compete against other little schools; so even these small places must be set alongside the great cities of England and the United States to get a complete picture of the effort put out by the United Nations in this war.

The home of the groundnut is completely different. The country is open; there are great trees standing among the farm lands, which are sandy and windswept. The groundnut farm just before the harvest is covered with a creeping crop with leaves like clover. The nut itself grows on the roots in exactly the same way as does the potato. It is harvested in a similar way. The plant is pulled up and the nuts are freed from the roots or picked up from the soil. These nuts are, of course, the monkey-nuts (peanuts in America) that the monkeys like at the Zoo, but they are still damp and soft.

All over the north, from time immemorial, these groundnuts have been grown and used for eating as nuts or for the fine cooking fat produced, but the war has accelerated production. Whereas the palm kernel is a direct beneficence of Nature, groundnuts have to be cultivated.

Every year the ground has to be cleared and dug up, the seeds have to be planted, young shoots have to be tended, and the ground weeded until the harvest. This alone puts a severe limit to the amount of nuts that can be produced, but in addition the ordinary farmer with his wife and family work with simple hand tools and can only cultivate a restricted area of ground, much of which must necessarily be used for their own foodstuffs. The rest can be used for groundnuts, tobacco, onions or sugar-cane—the crops that bring in actual cash.

The effort, then, to increase production is a really serious effort which requires the whole-hearted co-operation of the cultivators. This has been freely given, but unfortunately it is not enough, for rainfall counts a great deal in the final harvest. In these northern regions Nature is very harsh : rainfall varies greatly year by year, and the dates at which it comes vary also. Groundnuts will not germinate or grow or ripen unless rain falls in the right quantities at the right times. Very often the farmer has to sow his complete crop twice over, and sometimes even three times, before the shoots appear. On the other hand, the crop, once harvested, requires scarcely any manual labour to bring it to market—compared with the palm kernel crop it is " money for jam." There is a drawback, however, in the greater distances it has to be carried to the buying centres, and donkeys, camels and pack-oxen are all used to carry the great leathern sacks of groundnuts across the plains of the north.

This nut yields a very fine oil which, masquerading under many different names, is common in the markets of Europe. It is found as salad oil, as sardine oil, as a fine lubricant, as an illuminant and, in its greatest disguise, in margarine. Though not as rich in vitamins as palm oil, groundnut oil is useful in the very dry country in which it grows and for war purposes : this latter point is witnessed by the huge tonnages bought by Germany before the war. The residue after the oil has been taken out is used for cattle food and manure.

FILLING THE GAP—RUBBER

At the beginning of this century there was quite a demand for rubber from the forests of the Yoruba country. The supply was spasmodic and uncontrolled and had the effect of doing damage to the trees, so various regulations were imposed to control it. In 1942, some thick slabs of dry, encrusted rubber were unearthed by backwoods farmers. They had been buried for over thirty years : hidden to avoid prosecution owing to some breach of then-existing regulations.

The trade died down, and, though a small quantity of rubber was brought from time to time, Nigeria made little contribution to the world supplies. The trees were still in the forests, however, and more trees had grown up, so when Malaya and the East Indies fell, Nigeria was once again able to produce its rubber. The great bulk of rubber previously came from the Far East. With its loss, Ceylon, and the basins of the Amazon and the Congo alone remained. To their output the basin of the Niger is now adding a reasonable quota, owing to the determined efforts of the Government to press forward rubber production.

All through the forests there has been a painstaking, exhaustive search for the wild rubber trees and the long vines that hang from the upper branches of the great trees, whose sap produces a kind of rubber. To the west of the Delta and also in the Cameroons there are organised rubber plantations, not large in area, but producing a good quality rubber. These are survivors of the original rubber production drive made before the last war and have been of great service in this war.

However great the energy and organisation there may be behind a rubber drive, the collection of wild rubber depends in the end on the individual collector. This is, in fact, the villager living far away from civilisation in clearings in the forests, whose simple tools of the trade are a knife for grooving the bark, rope slings for climbing the trees, and empty coconut shells or folded leaves to catch the juice flowing from the cuts in the bark.

This juice, or latex, is a white substance from which the rubber has to be extracted. This is done by heat. The juice is either heated over a fire or poured into boiling water ; the coagulated lumps of rubber resulting are rolled out into thin sheets for drying. Once the sheets are dried they can be easily transferred to a buying centre. The trade is a trade for all, from the man who collects by the barrelful to the man who is satisfied with a cigarette-tinful.

The yields of rubber have been very good, and though, in comparison with the great rubber-producing lands of the world, they are small, Nigeria's rubber is none the less a vital production.

FILLING THE GAP—TIN

Forty or fifty years ago, explorers feeling their way up from the coast into the north came across curious metal ornaments and thin wire-like pieces of metal. Investigation proved that these were tin. The tin was tracked down to an area, now called the Plateau, lying in the centre of Nigeria, where the land rises to a great treeless, undulating expanse 4,000 ft. above the sea, with higher peaks approaching the 6,000 ft. line.

The country was, and still is, occupied by people known to us as "pagans," an independent, self-contained collection of tribes, survivors of the original inhabitants of Nigeria. They stoutly resisted, for hundreds of years, the attacks of the slave-raiding peoples who lived round the Plateau. It was not until 1910 that it became safe for Europeans to walk alone on the Plateau, and then, from small beginnings in the country north of where Jos now stands, there began a great development of the tin industry. Hundreds of square miles around Jos have been prospected and pegged as mining leases and are being worked.

In 1929 the Plateau was producing one-tenth of the world's supply of tin, but the great slump in the succeeding years brought with it a restriction of tin production to keep the price at a workable level. This meant a drastic curtailment of the output, and, consequently, of the number of Europeans and Africans employed by the mines. A steady improvement took place just before the war, which was very fortunate, as it paved the way for the big increase in production which was suddenly demanded. At the beginning of the war, however, many miners joined up in the field companies of Royal Engineers formed as part of the Nigeria Regiment, and have served with distinction in East Africa and Burma.

Tin-mining is a simpler process than its name suggests. Almost all the tin deposits in Nigeria are what are known as "alluvial." In some cases tin has been carried down from some unknown source by rivers long forgotten, the beds of which are now covered by many feet of soil. In others, tin is found in the beds of existing rivers, and the recovery of this is the simplest form of mining. In both cases water plays a big part in the process. The water of the rivers is used to wash down their banks and carry away the earth and tin in a muddy mixture. This is passed through " sluice boxes," long, rectangular troughs with steps at intervals in them. The flow of water is checked at each step, and the tin, being heavier than the earth in the water, separates and falls to the bottom of the box ; from this it can readily be dug out when the flow of water is stopped.

Where the tin deposits are deeply buried, though excavations are often made by hand the work is slow, and mechanical excavators, steam-shovels and " dragline dredges " are used to speed up the removal of the top-soil. The deposits can then be removed either by manual digging, by small mechanical shovels, or by the water process.

It is a fortunate thing that Nigerian tin requires very little preparation once it has been mined. The most complicated process, after the washings to free it from useless earth, is magnetic separation, to extract the particles of iron ore which are in some areas found with the grains of tin.

The mine areas are intersected by leats and waterways bringing water, sometimes from great distances. There has been a great improvement of recent years in the mechanical side, three well-equipped hydro-electrical generating stations having been opened. Much of the machinery on the Plateau is now electrically driven from the grids branching out from these stations, which are situated in wild and magnificent valleys in the escarpment of the Plateau.

The fall of Malaya and the East Indies called for tremendous efforts on the part of the mining community. Machinery was extremely difficult to obtain and had to be supplemented by labour on an unprecedented scale. Normal minefield labour consisted of about 30,000 Africans, some of them of the habitual labourer class, who came and went as they wished, others men and women from local villages who wanted money for taxes and for household purposes. Another 30,000 labourers were demanded, and these had to be obtained from all over the country.

This meant elaborate arrangements for transport by road and rail ; the construction and staffing of reception centres and new camps close to their work ; and great efforts to collect sufficient food for them to eat. The Plateau itself is not very fertile and only produces enough food for its own inhabitants. Wood, too, was a huge problem : provision of food would be no good unless it was properly cooked for each tribe in its own fashion ; the men came from warm areas to the biting cold of the Plateau, where it can be very cold at night and fires for warmth are literally vital. The men's health was of first importance—only medically fit men were allowed to leave their homes for this work, and, when working, they were given all possible attention to keep them well. Their own singers and drummers were brought with them to keep them in good heart.

The increased demand for food meant special calls on areas far afield which were already supplying great quantities of food for the Armed Forces, but all these difficulties were overcome by strenuous efforts and good will, and the new labourers settled down comfortably and worked well. The required extra tin was produced and sent overseas for essential war production.

NIGERIA'S OTHER METALS

More tin is exported from Nigeria than any other metal, but it is not the only production. Before the British occupation there was a substantial amount of iron smelted locally. At the foot of one of the hills in Kano City there still exists, as a ward in the City, a group of blacksmiths who come from the original line of blacksmiths of Kano City who have lived and worked on this site, generations of them, for a thousand years or more. All over the world, among primitive people, the trade of the blacksmith is a semi-sacred cult to which is attributed magical power. The leader of these ancient blacksmiths, the legend says, used to go out of an evening and kill an elephant for his supper with a stick. He would return carrying the carcass on his shoulder.

The smelting trade has largely died away as, in peace time, it was easier to obtain workable iron from the commercial firms, but this was worked here with great skill. In spite of this import, there used to be, and still is, a good deal of pilfering of iron fittings from the permanent way of the Nigeria Railway, to be made into useful tools.

The blacksmiths have not directly helped the war effort, but they have been easily trained in modern methods and have rendered great assistance in many technical directions.

There are several minor exports of once little-known metals which have become valuable. Columbite is found associated with tin. Before the war small parcels of this metal were sent to the U.S.A. for experimental purposes. Now there is quite a tonnage exported, which is used in making high-grade steel. The proportion of columbite to steel in the alloy is very low, and even a small export is not without importance. There is one place on the Plateau which is almost a columbite mine, as the ratio of columbite to tin ore is 5 to 1, the reverse of normal.

Wolfram is another minor ore which is used in the manufacture of fine steel. This again is associated with tin ore in certain districts, and a Board has been set up to expand production to the utmost. Like columbite, it is used in small quantities and even unimpressive tonnages are of value to the war effort.

Another interesting metal found in Nigeria is tantalum, which is used in making high-speed steel. Two deposits of tantalum are known, and there may be others. There is no extensive mining, but there are possibilities. Ilmenite, used as a raw material for white pigment, is found in large quantities in the dumps of waste products from the tin mines. So far, there is no great demand for it, but considerable supplies are available in case they are required. Graphite and mica exist in a number of places, but the quality is not good enough to justify production as long as other supplies are available.

COALFIELD RESPONDS TO GREATER RAIL AND SHIPPING NEEDS

A far greater tonnage of production than that of metals, in fact thirty to forty times that of tin, comes from the coalfield. In 1909 coal was found in the River Ofam, near Enugu, in the Eastern Provinces. This is an agricultural area, a pleasant place of downs and valleys, where the steep escarpments fall down into the river. These escarpments have now been penetrated by the adits of the Government Colliery. Below the hill is a rapidly growing African town and a charming Government Station of red brick buildings and green lawns—the Headquarters of the Eastern Provinces.

The coal found is not of high quality and does not compare with Welsh steam coal, but is amply good enough for local purposes. Before the last war, coal for the Railway and the Marine was imported. Before the present war there were no imports for these purposes, coal was exported from Enugu to the Gold Coast, and shipping was coaled at Port

Harcourt. The average output before this war was about 300,000 tons per year. Since then it has been greatly increased.

The coalfield extends for many square miles, and it is estimated that the possible reserves are well over 400,000,000 tons, but as the field recedes from the centre, the quality of the coal diminishes.

It was to serve this coalfield that the eastern line of the Nigerian Railway was built, and a special port, called Port Harcourt, after the Secretary of State for the Colonies at that time, was built in the swamps of the Niger Delta. There are special facilities at this port for handling coal for export, and the Nigerian Government maintains colliers to carry coal by sea from Port Harcourt to Lagos. The huge increase in railway traffic due to military needs and the export of produce for war purposes, the requirements of the surrounding territories, and internal needs swelled the demand very greatly.

TIMBER FROM THE FORESTS

A wide belt of Nigeria parallel to the sea is covered with high forest. In some areas you can walk for many hours through these forests, and, except in the clearings in which the towns and villages are found, you will not see the sun. The forests have in them magnificent timber trees of many different kinds. Before the war there was a useful export of timber from Nigeria and, oddly enough, a small import as well—soft wood was brought in for the packing-cases that protected the old 4-gallon petrol tins. These cases and the tins were of great value in the bush. The export was of fine furniture woods, which were so good that they were used almost exclusively to make thin veneers with which to cover indifferent timber. The war stopped the export of this luxury line, and the shortage of shipping made it difficult to get soft woods from the U.S.A.

It might have seemed that the timber trade would come to a standstill and that Nigeria would suffer through shortage of soft timber imports, but actually the reverse was the case. Shortage of soft woods stimulated search for that kind of timber in Nigeria, and it was found that ample was available. But the real stimulus to the timber industry, and its real contribution to the war, was the help it gave to construction of works for the Services.

Not only were huts, offices, stores and hospitals built from Nigerian timber in Nigeria, but a big export grew up, from Nigeria to the other West African Colonies, of timber and frame houses ready for erection. A great quantity of timber was also used in the construction of furniture and fittings for these buildings, not to mention bridge-building and the timber required for shuttering concrete and for railway sleepers. There were also many minor but useful things made from timber: for example, 75,000 tent-pegs were made and shipped within four days of an order being received; and many thousands of sets of draughtsmen and boards were made for the Services.

It is difficult to know what the country would have done, also what the fighting Services would have done, without this supply and without the means available for turning the raw timber into the finished product. Existing sawmills at Lagos and Sapele worked overtime, and so did the many smaller workshops scattered throughout the country. A good deal of research was undertaken in the north, and even in comparatively arid areas trees were found which could be used for building purposes and for the rougher kinds of furniture.

Part of this advance was made possible

by the opening of a pilot sawmill at Aponum, in the Ondo Province. The function of the mill, which is an experiment in running this kind of industry on a sound basis, is to make use of the secondary types of timber and the parts of selected timbers which are normally wasted. These are used for a great variety of local purposes, including shingles for roofing, in place of corrugated iron, and boards for making boxes and simple furniture. This type of mill is small and simpler to run than the conventional sawmill, and has the advantage of being close to its supply of raw material. In the past, development has been greatly restricted by the difficulty and cost of moving logs from the forest site to the mill.

MINOR FOREST PRODUCE

The Nigerian forest does not only produce timber. It produces other things, and the total cash value of the industries involving these " minor products " is not short of half the value of the exports of timber. The war has affected the demand for them, and there has been a big increase in their production.

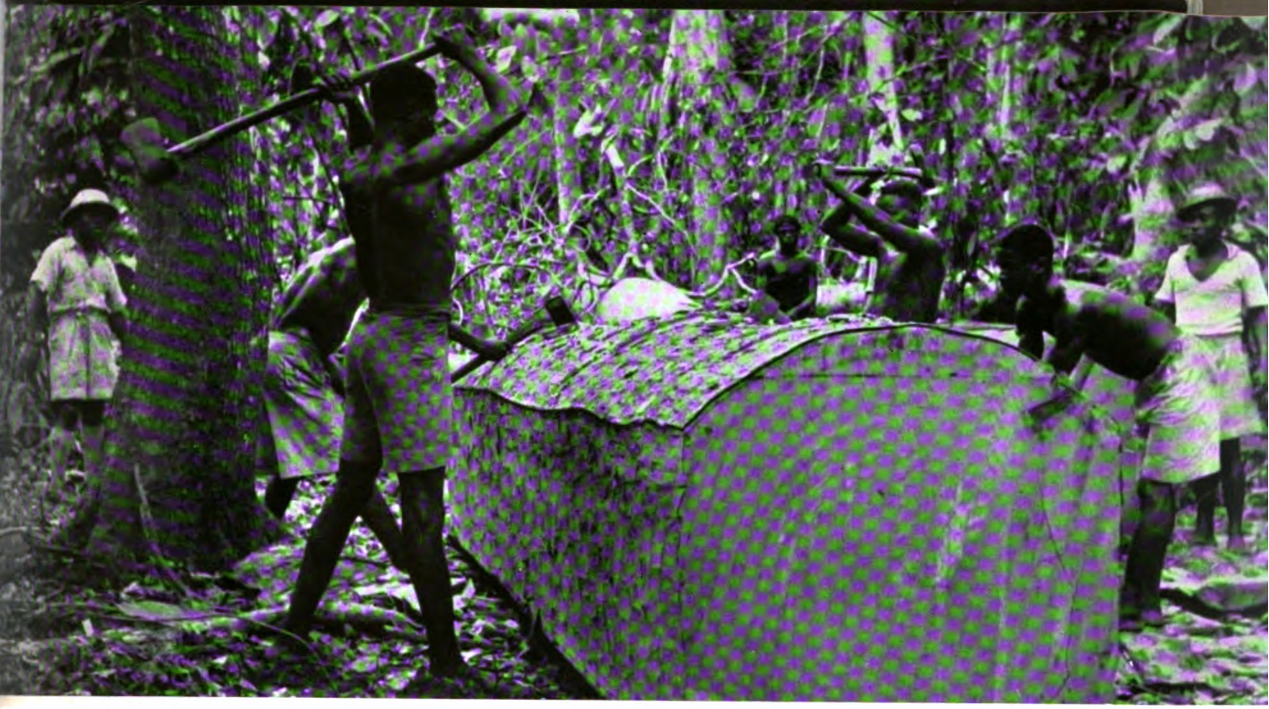
We have already spoken of wild rubber, and we will devote a section to the important produce of the raphia palm. Honey and beeswax will also be dealt with later on, but here are some of the products which, though important, can only receive a short reference.

Silk used to be imported to embroider the gowns of the rich. But even then local silk was spun and used in this trade. It was not, however, until external demand for silk for war industries became great that a determined attempt was made to use the wild silk made by the anaphe worm. This silkworm is found in many parts of the country, but is most plentiful in the Provinces of Zaria and Bauchi. People have been collecting it in these areas for many years, and their methods of collection unfortunately reduced the quantity available, for not only was the cocoon valuable, but the pupa which lived inside it was a tasty morsel. To avoid destruction of the species, " nests " or " cocoons " which contain pupæ are not accepted, and the species is therefore being preserved. This is a minor industry, but is one which has been of use in making parachutes and light fabrics. The tonnages are small, but as the product is very light the mere weight conveys no picture of the importance of the trade.

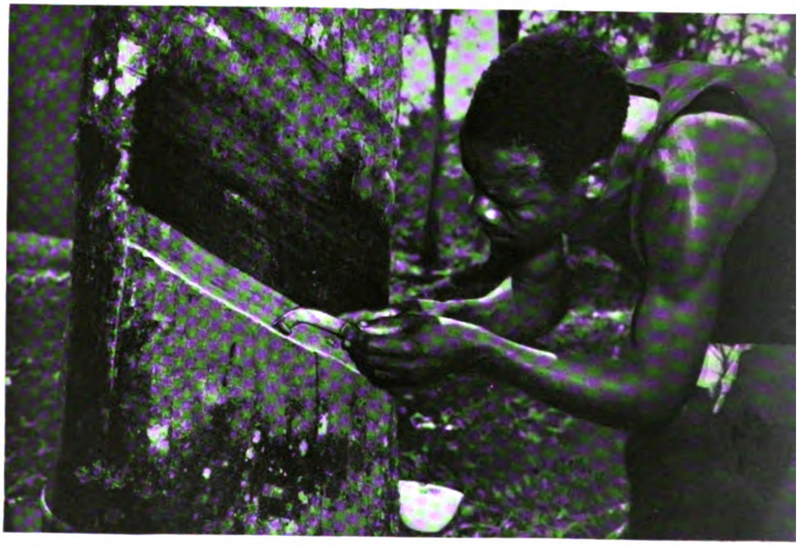
Another light product is kapok, which is found all over the north. It grows on great trees rising dozens of feet high into the air, without knot or branch, until they open into a graceful, leafy cone high above the ground. This tree produces a great scarlet flower ; after the flower there comes the seed-pod, which bursts, and white, feathery tufts of silk drifting like snowflakes carry the seeds gently to the ground. These white drifts are kapok: it is used in the manufacture of lifebelts, and Nigerian kapok has come into use after the fall of Java. Many other trades make use of it, and large quantities have been supplied to the Services.

Linseed oil, or rather a substitute for it, can be obtained from certain trees growing in the Northern Provinces. Charcoal, a small industry before the war, has been used extensively in producer-gas units for driving workshop plants, apart from the thousands of tons which have heated irons in the Services' laundries.

From the deserts of Bornu comes the gum-arabic which is made into commercial gum and which in peace time was the basis of the gum pastille. It grows on short, stunted acacia trees round about clay swamps in that area. This again is a



Timber felling in the forests of Nigeria. A sida log—one of the finest furniture woods produced in Nigeria.



Cutting the bark of a rubber tree in the Niger Delta. The sap, or latex, of this tree, which is rubber, drips into the small vessel at the bottom of the picture, from which it will be removed for further processing. One man can tap 300 trees a day in this way.

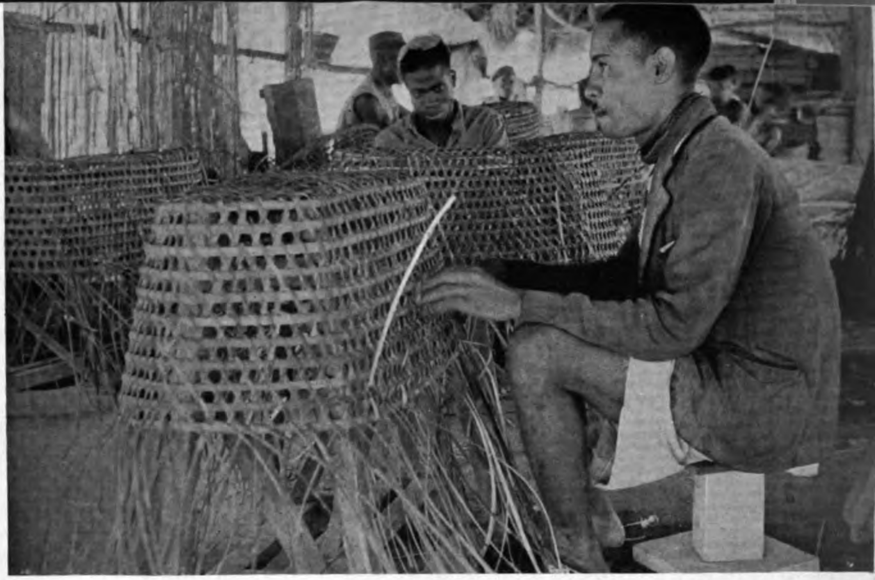
An African cutting out the " heads " of palm kernels on a young oil palm. When the tree is older he has to climb up it with a rope sling. The oil from this tree is used in the manufacture of margarine and foodstuffs and also in tinplating.

Above : *This photograph shows the hill in which the main Nigerian coal seams are located. In the foreground is one of the model villages recently built by the Nigerian Government for the mine's labour.*

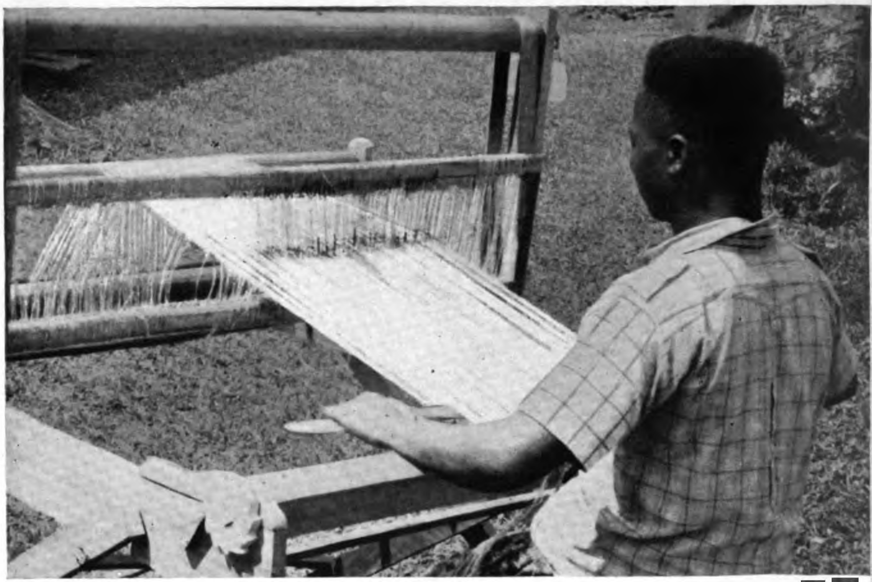
Left : *The tin mines of Nigeria are producing valuable ore for the war effort. The simplest form of mining is shown here.*

Below : *Groundnuts are the biggest export of the Northern Provinces. They are used greatly in making margarine, edible fats and fine lubricating oil. A chief inspects groundnuts from the villages.*

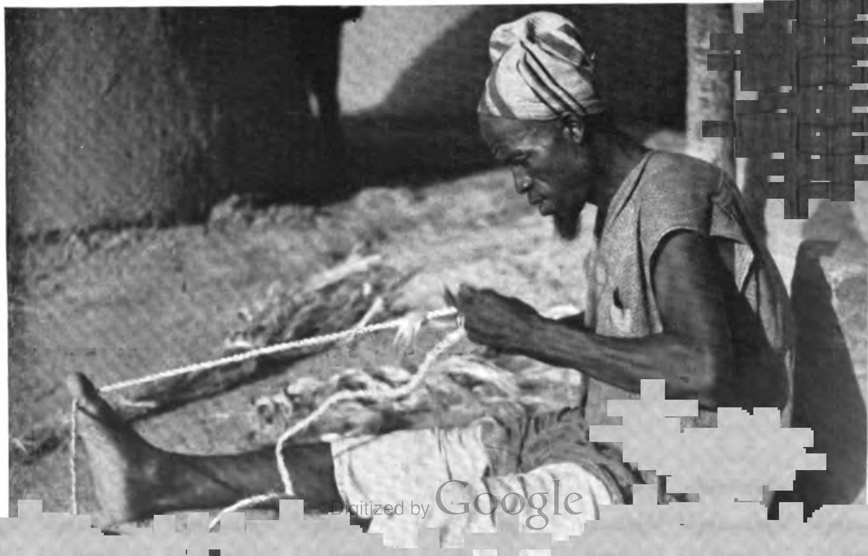
Military works and the collection of produce have promoted very greatly the local indigenous trade of basket-making from various local materials. These baskets will be used for carrying palm kernels.

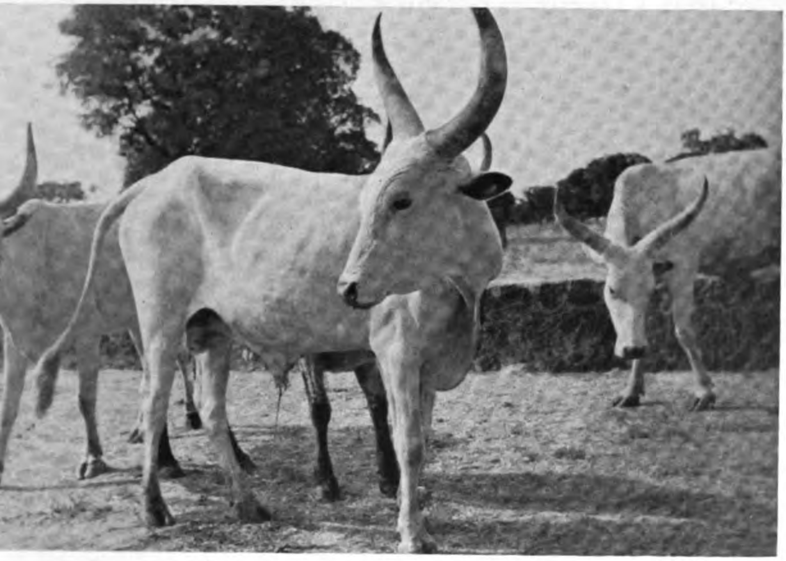


The war has stimulated, owing to shortage of imported goods, the native cotton-weaving industry. This picture shows the improved type of loom now used.



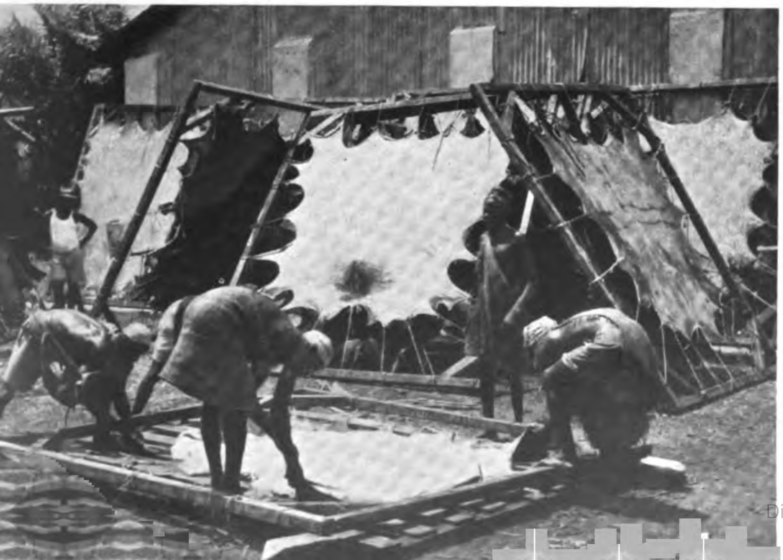
The Nupe in Bida make rope from local materials. The war has created an enormous demand for ropes and twines of all sizes and lengths.





Above : *The fall of France brought to Lagos, which is very near Dahomey, then a "Vichy Colony," the possibility of air raids and made a large civil defence organisation necessary. Thousands of people, both white and coloured, volunteered for this service, and here is a column of wardens marching past attheir last parade.*

There are millions of head of cattle in the Northern Provinces, and their hides and their meat have been of the greatest value to the war effort. Here is a fine Fulani bull which is typical of these cattle.



Hides and skins are among the most important exports from Northern Nigeria. Here one skin is being stretched to its frame while others, already prepared, hang drying.

light crop in weight, and though the work consists merely of breaking the exuding resin from the red tree trunks of the acacias, it takes a great deal of effort to produce a ton. The American soldiers get the substance of their chewing-gum from "Niger gutta," which is the local equivalent of the "chicle" found in Central America.

All these are small industries, small collections of small products, but their aggregate has not been without its effect.

RAPHIA WORK

This term suggests something rather fine and ladylike, but actually it can be used to cover all the products of the raphia palm. The palm grows in marshes and swampy land near rivers and is found in large quantities all over the country except in the very dry regions. All palms look alike to the newcomer, but this one can be distinguished by being short and thick in trunk and by the enormous leaves which it grows. The leaves are often 30 ft. in length, and the centre rib is very valuable, taking the place in Nigeria of the bamboo in the Far East. It is not hollow and so cannot be put to all the uses of the bamboo, but it does replace it in many ways.

For centuries it has been used in framework to carry the thatched roofs of the huts. But its other uses in house construction and for other purposes are very numerous. In many areas the walls of the houses are made exclusively of these poles tied to framework made of the same poles. The ribs can be made into chairs and tables or used as thwarts in canoes, for masts, and for market stalls. Most of the canoes on the rivers are poled by these palm ribs.

When split, the ribs can be joined together with light cord to make very good matting, not so much for floor covering as for roofing and shade. On light frames the ribs can make doors, windows and ceilings, and when painted last a long time though exposed to the weather. The making of the mats is a big industry in the Niger Province, and from there, in peace time, large quantities used to be exported. From the small leaves that grow from this mid-rib are made rain capes, produce bags and cordage, and the big domed hats which the Hausas use to cover their bulky turbans for protection against sun and rain.

The war has increased all these utilities. There has been an enormous demand for roofing timber, and schemes had to be put in hand for the maintenance of existing raphia palms and the speedy planting of new ones. The demand for mats for military buildings has also been very great and has caused quite a boom round the Niger.

Perhaps the biggest development of the use of this palm is in the production of sacking. Before the war more than ten million sacks were imported into Nigeria, costing over £200,000 a year. To continue these imports became impossible during the war, and they have been almost entirely replaced by local sacking. An otherwise obscure people called the Nanev Clan, who live on the northern banks of the Benue River, decided the size of the sack, for it was they who made the original types before the war. Sacking is made on a hand-loom from strips of raphia thread 18 in. long and ¼ in. wide. This industry caught on and became extremely popular among peasantry, who took to manufacturing sacks in very large quantities. Along the Niger and its tributary the Kaduna, and at Gusau in Sokoto, are the centres of the trade.

With this sack-making industry a twine industry has grown. Twine can be made from the raphia leaf, but for the most part it is made from the long fibres of the rama plant, a kind of hemp that grows all over the north. This has been the source of native twine and cord from ancient times, but the restriction of imported goods has increased demand for it enormously. The trade use for rama twine is principally for tying the mouths of the sacks. Round Bida the twine industry has had remarkable success, and without mechanical aids, and twisting the fibres between hand and thigh, the workers produced 66,000 hanks in 1941 : in the first quarter of 1942, production exceeded that of the two preceding years. Excellent matting is made from these and other fibres for floor coverings.

A million yards of local rope has been produced during the war. This amount is that of the rope known to be made and does not include the vast quantities made for local consumption, of which there are no records. Fishing nets are made from strings of the fibre, and the military use it for pull-throughs for rifles and for camouflage netting.

Another small product of the raphia palm is piassava fibre, a coarse, heavy stuff which grows round the base of the fronds. This produces the finest bristles known for brushes and is used by the artillery for scouring gun-barrels. A big local trade has sprung up in making scrubbing-brushes and brooms.

An amusing side industry from the palm is the making of small models of motor-cars, motor-lorries and aeroplanes, which are made by the children and sold on the markets. The workmanship of these is very crude, but the ingenuity and skill are great and some of the details are very clever. Talking of toys, it is from this same palm that the people of Ikot Ekpene (in Calabar Province) made entrancing animals of startling but recognisable shapes, daubed with futuristic colours. Voluntary collections in this area found the money with which the craftsmen were paid, and the first consignment of the toys gained more than local fame—they were sent by the people of the area to the Lord Provost of Aberdeen as a present to the children of the men of the 51st Highland Division. The handing over by the Lord Provost was broadcast by the B.B.C. throughout the world.

HIDES AND SKINS

For many hundreds of years "skins" have been carried across the desert from the Northern Provinces. They came to Europe through the North African ports, principally those of Morocco, and so got the name of Morocco Leather. This fine substance is really the skin of the Nigerian goat. "Hides" is the trade name for the skins of cattle. We mention this because many people have lived for years in Nigeria without knowing the difference between the two.

The cattle hide produces first-class leather suitable for soling and heeling footwear and for making equipment of all kinds. Good leather bags are made from it. There is a very big native trade in leather work, both for strictly utilitarian lines and for attractive fancy and ornamental goods.

All over the north are huge flocks of sheep and goats and great herds of cattle that wander in search of pasture. Their movements are seasonal and they move down into the river valleys for the green grass as it withers on the uplands during the drought. The cattle are owned by the Fulani, who are among the most fascinating people of Nigeria. There are many theories as to where they came from—some say from India, some say they are the Philistines of the Bible, and yet others say they are the Hyksos, from Egypt. No man knows, and it remains an interesting matter of speculation. They travel with their cattle, which are their wealth, living in little grass huts close to the herds. Milk and cheese form their main diet. The flocks of goats and sheep are owned mainly by the villagers, who eat the meat —northern mutton is good—and sell the skins.

The official figures for the number of cattle (for cattle tax purposes) is two and a half million, with sheep at half a million, and goats at four and a half million. The true figures bear no relation to this at all : they are at least twice and possibly three times these numbers. Before the war, the yearly export trade was something like 780,000 hides, 600,000 sheep-skins, and five and a half million goat-skins. The demand for hides and skins has increased very greatly since the beginning of the war—both for export and for internal use.

The hides and skins industry is full of difficulties of a technical nature : it has always been difficult to get the people to flay the beasts properly so that the skins are not damaged by knife cuts, and to get the skins dried properly so that they do not develop " skin blisters " through over-drying, or decomposition through being too damp. There has been a very big drive to improve flaying and also to secure selective breeding. When they are properly flayed and dried, Nigerian hides and skins are greatly sought after by footwear and glove manufacturers in the United Kingdom market and elsewhere, and the skin of the Sokoto " red goat " is considered equal to the best skins in the world. Two enterprising ladies set up a " Windcheater Fund " in Nigeria. With the money collected they bought skins, had them made into leather jerkins or " windcheaters," and sent thousands of them to seamen.

GINGER

A small industry which was started in 1927, to assist a poor area in the south of Zaria Province, is the production of green ginger. By 1935 about 300 tons were being produced every year—about 8 per cent of the world's production. It was thought that the coming of the war would kill this small industry, but in 1942 the British Government asked for the whole crop to be reserved for the United Kingdom market. The interest in this crop was not confined to Britain, for United States importers have also been taking notice of it. A new pale lemon strain has been found recently, which is not only of a very good quality but is more attractive in appearance and needs less washing than ordinary green ginger. In dried form ginger has been on sale in native markets for many years ; it is used as a spice in native foodstuffs.

Saving Shipping Space

SO FAR this has been an account of products of Nigeria the production of which has been specially stimulated by the war for export or, in many cases, an increased use inside the country for military purposes. Now we come to those industries which have sprung up for a different purpose. Before the war, large quantities of goods were imported into Nigeria for use by Europeans and the better-class Africans. When shipping space became very limited it was thought that Nigeria would have to do without the goods, but in many cases substitutes were found and developed.

Rationing of whisky, gin, beer, tea, butter, flour and petrol has been in force on and off for most of the war. Yet other commodities have merely ceased to be imported.

Some of the productions we have already mentioned have been of things to be used in Nigeria (some of them have been exported) and their manufacture locally has been a big factor in saving space in ships. There are others which have not been exported, or which have been exported only to neighbouring territories.

FOODSTUFFS

The main lines have been foodstuffs. In this the tremendous herds of livestock have played the greatest part. Before the war, butter, cooking fats, tinned milk, cheese, bacon, sausages, frozen meat and so on were imported in considerable quantities and sold by the Cold Storage Company. Up-country people used to wait eagerly for the train which brought them frozen butter from New Zealand, cheese and kippers from the United Kingdom. In Maiduguri, the last airport of the old Empire mail route, frozen bacon, cheese and butter were flown from Kano and arrived still cold in the early morning.

These supplies were threatened with complete extinction at the beginning of the war. For Europeans living in Nigeria, these particular classes of food are vital for a healthy life. There was a great deal of apprehension as to what would happen if they could not get them. The Veterinary and Agricultural Departments, however, applied themselves to the problem and produced solutions. These did not come to pass immediately, and there was a time lag when people went without necessities, but wonders have been done, and this is an account of some of them. In reading the account, it must be remembered that not only had Nigeria to provide substitutes for use by its pre-war European and better-class African population, but also for the large numbers of Servicemen who soon began to be posted to Nigeria. While it is true that most of the Servicemen's rations came from overseas, the authorities did their best to use local foodstuffs as far as they could. These new developments have had the effect of producing completely new industries in Nigeria which will have a stimulating effect after the war. One of the great battles which the medical world has to fight is bad nutrition, and these new trades are the foundations of a great development for the future. Let us take them one by one.

BUTTER

In October 1939 one small churn and a small separator, with great labour and long hours of work, produced 600 lb. of butter in the month. This was one-tenth of the monthly average of ordinary peace-time imports. In two years not only had the quality of the butter been improved, but the number of dairy centres had been increased, equipment had been obtained, and 30,000 lb. of butter a month was being made. This supplied all internal demands and also those of the Services, including the revictualling of H.M. ships and the Mercantile Marine. This was a completely new departure, for as a rule all ships calling on the West African coast used to carry frozen stocks for the outward and return journeys. In addition to these demands Nigeria has been able to meet to some extent the butter requirements of neighbouring territories.

The Plateau Province, 4,000 to 5,000 ft. above sea-level, was the centre of most of these activities, and at Vom, the headquarters of the Veterinary Service, the first dairy was set up. Vom lies in the hills, tucked away in a small valley about 20 miles south-west of Jos. All around the low hills are great plains of fine grass, ideal for grazing herds of cattle, while around the station itself there are groves of casuarina and flowering trees. Great herds of Fulani cattle are found on the Plateau, but they are also common all over the rest of the north.

In spite of these great herds a limiting factor was the distance a Fulani woman would carry her milk to the market. This was about five miles—a five-mile walk each way would be enough for most people. Subsidiary buying stations were set up, and cream separated at them was brought in by lorry to the dairy centres, which were at first mostly on and around the Plateau, but later a new dairy was started at Kano, and there separate supplies of butter were churned and put on the market. On first acquaintance this butter has a slight flavour, but after a few days the ordinary European palate accepts it as readily as English butter. This industry has so far only lightly touched the resources of the country, and after the war there is no reason why butter at a reasonable price should not be available in quantity for all who want it.

HOME-MADE CHEESE

After the butter industry came the making of cheese. This was not at all easy, and it took some time to overcome, in a tropical climate, the difficulties of the trade, but before long a cheese of Cheddar-like quality was being produced. In this product the supply has not met the demand, and, especially during the dry weather, when the quantity of milk produced by the herds falls off, there has been a definite shortage. Equipment, such as it was, was manufactured by the Public Works Department and, although " Heath Robinson " in some respects, has been very successful. But the uncertain quantity on the market and the differences in quality of the milk have made it difficult to establish proper routine. Its manufacture is centred at Vom, and recently a new dairy was constructed in the southern part of the Plateau Province.

"C.B.F."

These initials, unknown a few years ago, are now commonplace in Nigeria for " Clarified Butterfat." Before the war the purified form of butter from the Fulani cattle, known by the Indian name " Ghee," was obtainable. Though perfectly pure, the butter was usually far from fresh, and the fat had a rancid flavour. There was a big demand for this by manufacturers in the United Kingdom, who had their own ways of deodorising, but it hung fire in Nigeria until the C.B.F. industry was able to cope with the situation. It is a simple process. After separating the cream from the milk, the former is heated to remove excess moisture, and the resulting butterfat is packed in petrol tins ready for moving. A secondhand separator, a sieve, a funnel, a mud oven, a few lengths of muslin and some petrol tins made up the equipment of the first experimental unit.

The industry grew from a single mud hut on the roadside in the south of the Plateau to a number of well-equipped units scattered throughout the area. The scenes at these centres are strikingly picturesque. The Fulani women begin coming in at about 9 o'clock in the morning. They are tall, graceful people, wearing long white cloths wrapped around their slim bodies. They have fine, small features and enormous brown eyes; their straight hair is gaily dressed with metal braiding and rings. On their heads they carry big carved and decorated calabashes of milk. They are quite unlike the ordinary tribespeople of the district.

Now that these women have money to spend from the sale of their milk, their own perquisite, the money is spent on rows of jingling bracelets, strings of multi-coloured beads or coral necklaces, golden pendants for their ears, and glittering ornaments for their long black hair. Small markets have sprung up round these buying centres, where these flashy wares tempt the eyes of the milkmaids, where professional hairdressers dress their hair in many attractive styles, and where seasoning herbs, grain and meat can be bought to take home for supper. The industry is not yet fully grown but is sufficient to meet present needs for cooking fats in Nigeria. It must be understood that most of the African tribes use fats from palm kernels and groundnuts for cooking. The use of C.B.F. is confined to more educated people.

BACON

Vom once more comes into the picture as the home of the first piggeries in Nigeria. There have been pigs in Nigeria for hundreds of years, but no real attempt was made to make use of them until recently, for there was always a well-grounded fear of disease lying in their flesh and the ordinary European would not touch it. Vom began to produce bacon scientifically in 1941, and this fear has now been dissipated. In five months in 1941, 65 carcases at Vom and 58 at Lagos were turned into bacon and ham. In 1942, 240 were dealt with in each place. Before long the Vom figure alone will be 1,400 carcases a year, that is about 140,000 lb. of bacon.

MEAT

In peace time meat was imported from Europe for European needs alone. The local population ate meat when it could afford it or when something died and had to be eaten, or again when animals were sacrificed for the big religious festivals. The ordinary African in Nigeria is not a rich man in cash, though in kind he usually has ample for his own needs and for those of his family. With all the millions of head of livestock in the country, meat should not have presented a difficulty when it became necessary to feed the vastly increased European population and to provide rations for the tens of thousands of African troops who were introduced to meat in quantity for the first time in their lives.

In practice, however, it did require a good deal of organisation. Most of the meat available—and certainly the best quality meat—is to be found in the north, but the great collections of European population and of troops were in the south. Arrangements had to be made for local buying and for transport on the hoof. This again had a bad effect on the quality and quantity of meat, as animals travelling day after day naturally lose weight. Plans then had to be made for fattening these animals. The quality of the meat does not, of course, compare with European meat of the same types, but in the north, where the pasturage is plentiful, good joints can be obtained.

When we speak of additional Europeans, we must stress the very large numbers of Servicemen sent out from the United Kingdom, of the R.A.F. and United States ground-staffs, of transit passengers on the great reinforcement route to the Middle East, running into many thousands a month, and of the crews of ships, both naval and merchant, arriving in Nigerian ports with empty storerooms. In addition to the man-power requirements of the Army, between 30,000 and 40,000 additional labourers were gathered in the small area of the tin mines to step up tin production, and tens of thousands of labourers were concentrated on military works, and to them a proportion of meat was issued.

An interesting result of all this has been the fact that the ordinary under-nourished African has suddenly been brought up to ration scales of a splendour of which he had never dreamed. It was said, " Why not let the African live as he lives at home ? " The answer lies in the feats performed by West African troops in the field and by labour at home.

Though they are not strictly meat, we must mention chickens and eggs as being another supply problem which had to be faced. Many camps and airfields were built in areas with thin populations, and the provision of chickens, and especially of eggs fresh enough to be cooked, became a very big problem which had to be watched and organised. A similar problem was presented by vegetable gardens. Before the war, the small European population grew its own vegetables at the back of the compound, or depended on a so-called " station garden," which either produced good vegetables in enormous and unmanageable quantities or none at all for months at a time. A market-gardening trade sprang up in many places and produced comparatively large quantities of vegetables. In one station in the north, small in peace time but which became important on the reinforcement route, a quarter of a ton of green vegetables was produced every day by this means. This production has interested local Africans far more than was anticipated, and now in the markets there is a considerable demand for European vegetables to be consumed by the better-off African.

Some years ago in the extreme north there was a small native industry engaged in drying meat in the sun. It did not amount to very much, but during the war this trade—the biltong trade, to use a South African word—was taken up commercially in Kano, and hundreds of tons are railed each year to Lagos. Biltong is made of good quality meat with a high food value and keeps indefinitely in perfect condition without refrigeration, which is an important factor, as refrigeration is an expensive, though often a necessary, luxury. This trade was developed for the Services but will now survive in peace time.

FISH

While the West African does not eat a great deal of meat, he does like a nice tasty piece of dried fish, often surrounded by a column of smell that has to be cut away to see the origin. The great network of waterways and creeks used to supply a large amount of fish, but it is a curious fact that, in spite of this available source, vast quantities were imported from Norway. The loss of Norway meant no more stock-fish, and the Nigerian was hit very hard. A special drive was contrated under an Agricultural Officer, and enough dried fish is now produced to meet most of the demands. Sea fish is dried and sent inland, while freshwater fish is moved away into the less watered areas.

ONIONS

Very fine onions are a natural product of the country, probably introduced, like so many other useful things, by the Portuguese. But though production was great, organisation of distribution was necessary. This was undertaken by the Agricultural Department, with special regard to an onion which does not deteriorate quickly in transit. Experiments were made in the production of sun-dried onions, as these last longer and scale only a tenth of the weight of fresh onions. A consignment was packed in sealed petrol tins and six months later the onions were found to be in perfect condition. The onions were used for the Services and have been exported to some extent to other less favoured areas on the coast.

POTATOES

Only in certain areas in the north could you get local potatoes in peace time. Potatoes required locally were mostly imported. This, like other imports, fell to the ground, and Nigeria had to face a serious deficiency of this European foodstuff. The production of local potatoes could have been increased very rapidly, but there was difficulty in procuring seed potatoes from Great Britain and, in fact, the earlier consignments were sunk on the way out. The main supplies came from the Plateau, Zaria, Cameroons and Bornu Provinces, and something like 700 tons a year were being produced at the end of the second year of production. This more than met military and shipping requirements as well as the normal demands. These potatoes are of excellent quality.

HONEY

For centuries the rich men of the north have been using honey to make sweetmeats. This is semi-wild honey and it has a very fine flavour. In course of time the local peasants started making straw beehives, long tubular affairs, which they put in the branches of trees. Getting the honey out of these was an even more dangerous adventure than with the ordinary European hive, but, as in Europe, there are people who are " bee-men," impervious to their attacks. Smouldering spices and herbs were used to stupefy the bees. There used to be quite a trade in beeswax from these hives before the war, mostly with local blacksmiths and leather workers, and restrictions on imports have even increased the demand, for the treatment of furniture and woodwork being manufactured in great quantities for the Services. The Services, too, have used a great deal of honey. The only preparation involved is boiling and skimming to remove impurities. The result is a fine liquid honey which, unfortunately, is rather uncontrollable on bread but well worth the effort required. About 6,000 lb. of beeswax are produced a year and about 100 tons of honey. These figures should be advanced a great deal in the near future, as centrifugal devices for clarification have been introduced.

SUGAR

A donkey walking around a circle is the most expensive part of the machinery for producing local sugar. The donkey turns rollers working in sugar crushers ; sugar-cane is fed into the rollers and the juice is collected in tins ; after that it is boiled in 44-gallon drums set in mud furnaces. This is all a very simple process, but a good deal of judgment is required not to spoil the sugar in the boiling. When ready, the fluid is run off into earthen pots to be stirred, and then poured into small tin bowls. In these it sets and is sold all over the markets of Nigeria in hard blocks the shape of the bowl. The whole apparatus costs about £25, and there is a large number now at work. In three years this industry has jumped from single figures to over 1,000 tons a year. The preference of the people for imported white sugar has held back the development to some extent, but a new variety of brown sugar is being produced, a crystallised sugar which should be more acceptable. This is a war-time industry with a big future, for there are thousands of acres of sugar-cane available.

GRAIN CROPS

In the drier parts of the north, but not in the desert, quite a lot of wheat is grown, being ground on stones by hand for use by the great men. With the serious shortage of flour at the beginning of the war, attention was turned to this local wheat and its milling was taken up in earnest. The Services use a good deal, and those civilians who don't think that brown bread is necessarily degrading use it too. It produces, mixed with imported white flour, a very good brown bread.

Again, there are large areas growing rice. Before 1939 Nigeria was importing 10,000 tons a year. The demand has been greatly increased by the Services, and production has been correspondingly pushed up very steeply. Most of this has been done by use of propaganda and good prices, and not only have the old areas increased their yields by the energy of their cultivators but the production has spread into many new areas. The quality of this rice is good, and there is an increasing number of Africans who eat it as an ordinary foodstuff.

The concentration of large numbers of Africans as soldiers made special arrangements necessary for feeding them, principally with the corn—" guinea corn "—which is the staple foodstuff of the north. It was necessary for the Agricultural Department to buy tens of thousands of tons for immediate requirements and reserves. Though this was a great undertaking, an even more serious problem was the storage of the corn once it had been bought. In north-eastern Nigeria, a series of great pits was dug at each collecting centre. These pits were lined with matting and chaff, surrounded by a low wall, and covered with a thatched roof. From the outside they looked just like a row of huts: inside there was a 20 ft. drop to the floor. In these pits corn can be preserved very well.

FRUIT

There has been a huge demand for fresh fruit—oranges, pineapples, pawpaws, grapefruit, limes and so on—which has been met locally. A good deal of fruit has been turned into fruit juices and jam, which have been very popular with the Services.

Household Requisites

STARCH

WHEN THE Far East was overrun not only did rubber and tin become very scarce, but also starch, which was largely produced in Java. Nigeria used to import all the starch she required, but it was known that the cassava root, which is used as a foodstuff in many places, has a high starch content. So it was decided to produce starch locally from this root, and experiments showed that it could best be done in the Warri area of the Western Province. The washing of starch must be done in absolutely pure water, and this part of the world has a number of beautifully clear streams.

The operation is improvised and very simple. The root is crumbled into small pieces, soaked in water, and strained through muslin to remove fibres and impurities. The residue is ground on a flat stone with an empty bottle as a rolling-pin, and after this has been repeated several times good starch is obtainable.

Unfortunately, these primitive methods do not keep out dirt and grit as much as is necessary, and large quantities had to be refused. Help came from the British Government, who decided to carry out finer grinding processes in the United Kingdom, and Nigeria now sends starch to Britain in the first granulated stage. This has become quite a substantial export.

Trade and ingenuity have been stimulated in many other directions ; they may sound small, but in practice large numbers of people are involved and a foundation for the future has been laid. Basketwork has been used for many purposes connected with the war. Hats have been woven which have become popular locally, in the absence of imported articles. Brooms and scrubbing-brushes have been made with local materials, and cane chairs, originally made only in prisons, have come into enormous demand. Water-pots have been used by the hundred thousand, and special coolers—hollow water-insulated vessels—have been made for keeping butter.

COTTON

The imports of cloth from Europe have been reduced, and the making of cloth, one of the most successful of local industries, has had a big stimulus. Cotton is grown in many parts of the country, and, while some is exported, most of it is used locally, being spun into thread by the busy fingers of the women on simple bobbins, and woven into cloth—fine durable stuff—on equally simple looms. Dyed or plain, it sells in large quantities. Prisoners now make their own and enough for the Native Administration staffs. Local dyes, once ousted by German materials, have come into their own again, old herbal dyes having been revived, and old patterns have replaced the machine-stamped patterns of Lancashire.

MISCELLANEOUS

The leather men have had a wonderfully busy time, but in turn they have improved their methods, increased their skill, and greatly enlarged the variety of goods produced. Everyone visiting Nigeria buys Nigerian leather goods for use or for souvenirs.

Thousands of acres of matting, some fine matting for floors, some coarse matting for walling and ceilings, have been made by people in every village in the country and bought by the Services. Millions of bundles of thatching grass have been brought in to cover the thousands of huts and houses made necessary by the emergency. Nails vanished off the Nigerian market and had to be made locally. Hinges and bolts were made out of old motor chassis Enormous ingenuity has been shown all over the country in making good apparently insuperable deficiencies.

Special mention must be made of two industries which will obviously become important. The first is the manufacture of soap, which is undertaken on a commercial scale with the most modern equipment at Apapa. Domestic and a small amount of scented toilet-soap have replaced almost all imports from outside Nigeria and have supplied the requirements of the rest of West Africa. An important side-line to the industry is glycerine, which is shipped to Britain for the manufacture of explosives. The other industry is the local burning of cement. This is really still in the experimental stage, but the tests have proved that there are possibilities for the future. Brick and tile works have expanded and have made their old efforts seem feeble.

Physical War Effort

THE TIME has not yet come when it is possible to tell the full story of Nigeria's physical share in the war. Her people were fortunate in that they were not exposed to the terrors of invasion and of bombardment. But if they were not exposed to the actual thing, they were nevertheless exposed to its threat.

At the beginning of the war, Nigeria was surrounded by friendly French territory. At the end of June 1940 that territory had changed overnight from being a friendly area to one which was at least doubtful in its intentions though not actually hostile. The indications were that the Germans would use the French Colonies as a base to mop up the four British West African Colonies.

At first sight there might appear to be a little justification for such an idea, but after the loss of France, Britain decided to carry a reinforcement route from the Gold Coast through Nigeria to the Sudan and thence south to Kenya, north to Egypt, east to India and China, and to Russia when the last named came in. Along this route were flown thousands of fighters and bombers and many thousands of transport planes loaded with essential stores, key technical personnel and officers of high rank. The existence of this route, quite apart from the supplies valuable for the war effort which were coming from Nigeria and the other West African Colonies, would have justified German invasion. On this route depended important events in Egypt.

At the beginning of the war Nigeria had its peace-time military force of four battalions of infantry and a battery of artillery, with some signals personnel—African rank and file, with British officers. These were fine troops, highly trained for their task—that of keeping order within Nigeria's borders. They formed the Nigeria Regiment, part of the Royal West African Frontier Force, which embraces the military formations of the four West African Colonies.

Reservists were immediately mobilised and vital points were guarded: the Lagos Defence Force, then a voluntary body, manned defences by night and worked in their ordinary offices by day. Ancillary services were started; field ambulances were organised, civil doctors being given commissions; field companies of Sappers came into being, with public works and mining engineers as their officers and African craftsmen as other ranks. The Nigerian Marine painted its ships battle-grey and took on war duties.

Then Italy came into the war and a Nigerian Brigade was formed for service in East Africa. The gallant work they did there is now well known: their dash from Mogadishu to the highlands of Diredawa and their fighting in the Omo valley and around the southern lakes of Abyssinia have passed into military history.

Meanwhile recruiting had gone ahead with vigour in Nigeria, and many thousands of recruits had joined the Colours. These were all voluntary recruits, men from all parts of the country, infantry from the fighting tribes of the great northern plains, and technicians, motor drivers and pioneers from the areas south of the Niger and Benue.

Their training went ahead rapidly. Large numbers of Rhodesian and British officers and N.C.O.s were shipped to Nigeria to take their part in these new forces. More Europeans were found in volunteers released from Government and commercial offices, and many African clerks enlisted freely as clerks in the R.W.A.F.F. The enlarged forces were urgently needed, not only for the reinforcement of the Brigade overseas, but for the defence of Nigeria should the enemy decide to attack.

The ancillary services were greatly increased : a West African Royal Army Service Corps came into being, with thousands of vehicles ; Africans manned anti-aircraft batteries ; every variety of modern weapon was imported, and the troops were trained in their use. Battle schools were started ; technical training schools turned out hundreds of skilled men ; fitters, electricians, drivers, carpenters, masons and blacksmiths took their places in the Regiment.

The Brigade came back from East Africa after the first definitely victorious British campaign of the war. They were re-equipped and trained. With others, they formed the 81st (W.A.) Division which went into action against the Japanese in the Kaladan valley and as Chindits under Wingate. There they gained fresh reputations and even the great Indian fighting peoples accepted them as worthy comrades in arms. The work of recruiting and training has gone on without slackening and more and more Nigerian troops have landed in India.

Every European male not released for active service was subject to compulsory local service and served either in the Defence Force or in Civil Defence, or sometimes both. Every station in the country where there were Europeans had parades and training in military matters, and in this they were joined by comparatively large numbers of African volunteers from the clerical and technical staffs.

The European women in Nigeria were not to be outdone by their sisters in Britain, and worked in offices to release men for other duties, in canteens to help the Servicemen, and helped in knitting and sewing for the bombed out in England.

In the big towns along the frontier and some of the more important places inside the country, Civil Defence was organised on British lines. The staffs were not full-time and were for the most part voluntary, but they were large and well trained and might have made all the difference in an emergency. In Lagos alone there were over 2,000 Wardens. Fortunately, their services were never needed, and the nearest that a hostile aircraft approached Nigeria was when a lone plane attacked Fort Lamy, in French Equatorial Africa.

The Royal Air Force, who supplied the ground staff for the chains of airfields, and the Royal Navy in the ports, called for construction works on a scale huge for a country such as Nigeria. This was an enormous task and ranged from digging trenches and building machine-gun posts to laying out huge camps, clearing and making vast airfields, and building roads in extremely difficult conditions. Most of this work, for all the Services, was carried out by the civil Public Works Department, which, with a shortened staff, had to carry a weight without parallel in its history.

Postscript

AND THAT IS THE STORY of the contribution of one Colony to the war effort of the United Nations. It is not the full story. Figures, and details of some of the most exciting things that happened, cannot be published, but even in its bare outline it is a good story, one story of many others which have made the rest of the Commonwealth very proud. There was so little compulsion, so much voluntary effort, and so great an enthusiasm that it makes one rather humble, too. This great effort, unlike many war measures, will not be wasted, for, from experience gained and the new industries opened, Nigeria will undoubtedly prosper after the war to an extent no one thought possible before.

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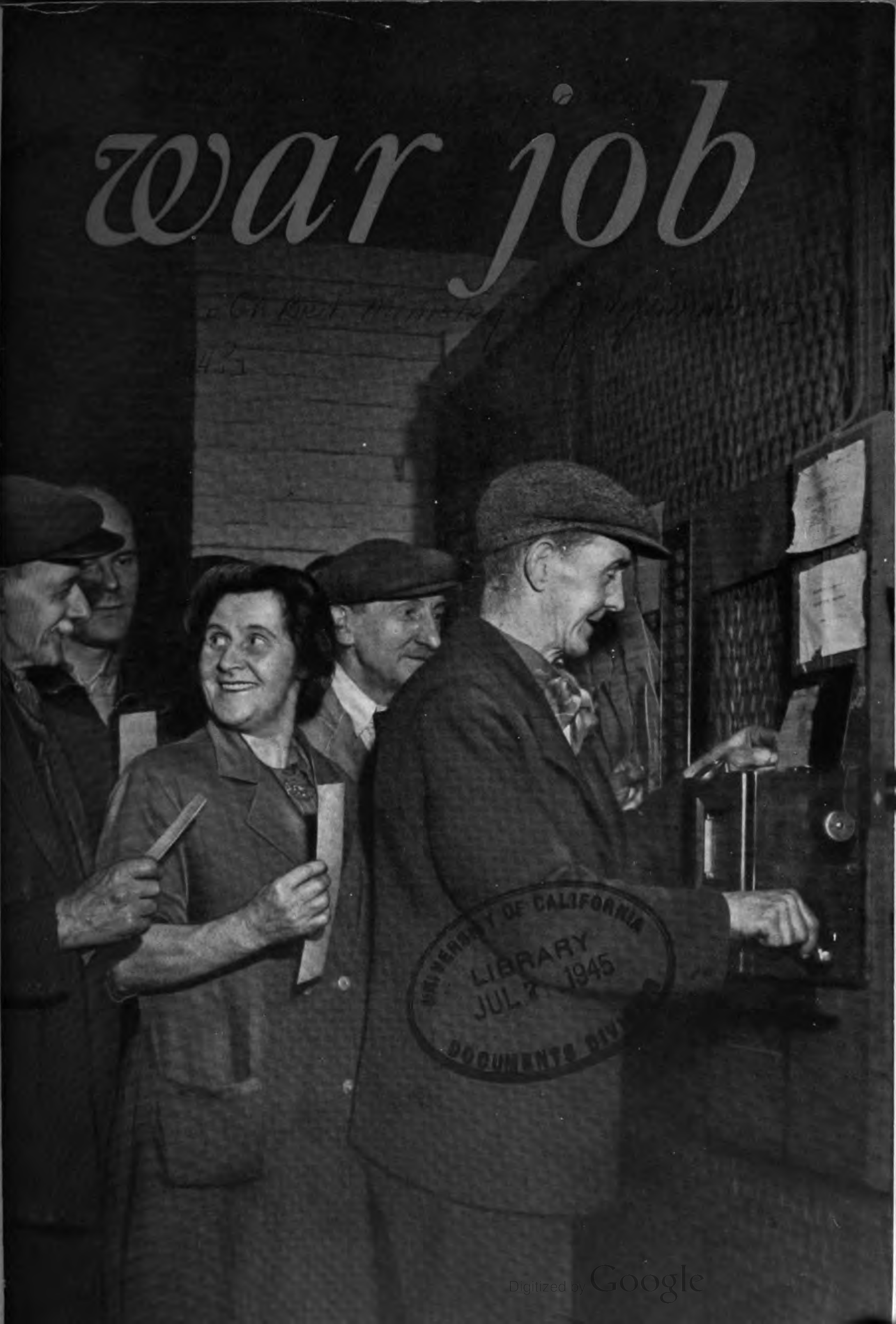
NIGERIA

war job



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Three years ago there were fields and woodlands . . .

G.P.D. 39/490

where a huge ordnance factory now stands . . .

Three years ago there were fields and woodlands where a huge ordnance factory now stands—a factory with miles of single-storied camouflaged buildings, railways and concrete roads; a factory surrounded by barbed wire, fed by water mains and power cables, and employing perhaps 20,000 people. At another location, in a big engineering works by the side of a river, one can see a relatively small block obviously older than the rest; there was nothing else in 1938, and the satellites, bigger and more numerous than their nucleus, have been created to provide the equipment for modern war. In these factories some of the men at the machines were wearing "city clothes" a couple of years ago, not overalls, and many more were in luxury trades. This elderly storekeeper had retired from business. These girls working on automatic machines, or carrying out skilled work in the machine shop or the drawing office were typists or housewives or shopgirls and had never been in a factory two years ago. All these people are working in harmony side by side with those of the pre-war personnel who have not been claimed by the Services.

After Dunkirk, Britain had in the country only 200 light tanks, armed with machine-guns, and 50 infantry tanks. Most of her meagre equipment had been lost in France, and the military forces in the British Isles were hardly armed at all, by modern standards. In aircraft, the position was a little better, but the Battle of Britain was "a damned close-run thing," to use Wellington's phrase about Waterloo. The Navy's needs were urgent and great to meet the tremendous new demands made on it.

Only two years later the Minister of Production could state that Britain was at least within sight of maximum production and he could quote huge figures for Britain's munitions output. In the air thousand-plane raids were possible, with all machines of British make. Large quantities of arms had been supplied to Britain's forces in the Mediterranean and the Far East, and all promises to Russia had been kept.

Britain's present production per head of the population is the highest in the world. It has been attained with enemy bases near enough to compel a total blackout, in the face of heavy attack from the air, at a time when a high proportion of the younger men—and women—are in the forces, and with a measure of dilution of skilled labour never before known. The achievement speaks for itself; in the pages that follow an attempt has been made to translate the general into the particular, to express what has been done in terms of the individual worker, the individual executive, the individual factory; and to show, by some examples, why our industrial war machine is so efficient. Such great ends are not reached by brilliant makeshift or frenzied effort; they do not come by chance or because of a genius for muddling through. They are the result of planning, organisation and the full use of individual skill and national capacity for production; of industrial experience, hard work, inventiveness, initiative, courage and perseverance applied by the people of Britain of their own free will to the business of winning the war.

"He went to her and asked: 'Why the black looks?' She said: 'It's not my fault. By rights I should be home now, but my relief is ill and not coming in, so I'm doing her shift.'"

1. AFTER DUNKIRK

> "*All this comparatively small force of tanks (with the B.E.F.) was entirely destroyed or lost at the time of the French collapse. We had 200 light tanks armed with machine-guns, and 50 infantry tanks—that was all that remained to us for the defence of our country.*"
>
> THE RT. HON. VISCOUNT CRANBOURNE, July 1942.

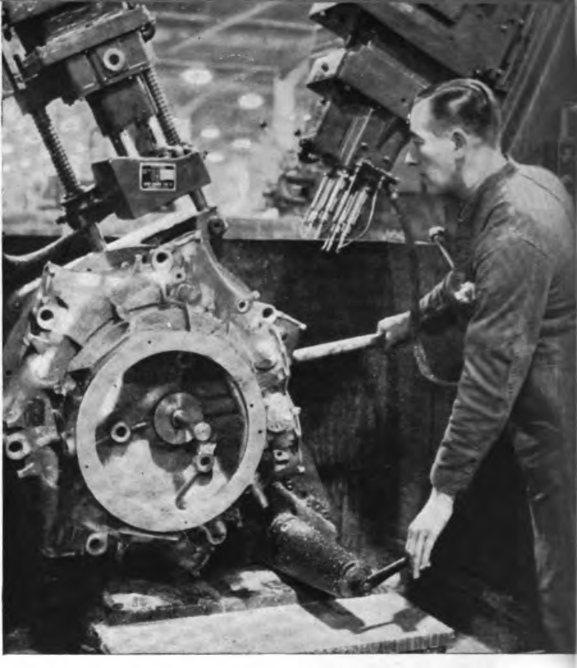
> "*Reckoned as a three months' effort and measured by our immediate defence needs, this (the re-armament of our forces after Dunkirk) is an achievement indeed.*"
>
> THE RT. HON. HERBERT MORRISON, August 1940.

NOT long after the fall of France a factory manager was walking round one of the shops, and he noticed that, although the shift had only just started, one of the girls was looking very dirty and begrimed. He went to her and asked: "Why the black looks?" She said: "It's not my fault. By rights I should be home now, but my relief is ill and not coming in, so I am doing her shift." The girl was turning 25-lb. shells at 45 an hour, which meant that she shifted sixteen tons of metal in the sixteen hours she was on that day.

The story is typical of the sense of urgency that was felt throughout Britain in those grim days when the promise of many weapons in the future was useless unless enough could be produced immediately to avoid defeat. For a time it was a tale of long hours at high pressure. The need was desperate and the workers were eager to give everything they had, so that for a hectic month or two factories on such things as aircraft parts were working a seven-day week, sometimes of more than seventy hours. In one engineering firm men were found in August who had been working a 76-hour week since mid-May. That sort of thing could not go on indefinitely if output was to be maintained—it was only the spirit of the people that made such heavy strain possible even for a short time—and it says much for the efficiency of the control of Britain's industry that the lessons of the last war were not forgotten in spite of the continuing grave danger of the situation. Hours were very soon reduced to a level at which pressure could be fully maintained over a long period. Even during the Battle of Britain, when most of the world thought Britain could not survive, she was looking ahead and planning the transition from spurt to staying stride.

When so much has happened in the interval it is not easy to recapture the spirit of such a phase as that which followed Dunkirk. The determination of the people produced that incredible spurt, and its value can hardly be overestimated. Anyone associated with war industry in those days could bear witness to the amazing change that came over everyone. The Works Manager of an engineering factory says that he could not believe at the time that Dunkirk could have made such a difference. "When I saw some of the records," to quote his own

A 19-year-old girl, formerly an assistant in a tobacconist's shop, grinding the rivet heads on a tank.



A skilled engineer at work on the "Hercules" radial aero engine, the power unit of many famous British aircraft.

words, "I was surprised because I know the cycle times of the machines and fatigue allowance, and I thought something had gone wrong. So before paying piecework wages I investigated and found the figures right. I next timed the machines and found them right speed and feed, so I stopped in the machine-shop for 24 hours without a break to find out exactly what was happening. This is what was going on. Operators did not leave their machines for more than an average of 3 minutes in an 8-hour shift. They had their lunch in relays, and instead of 30 minutes took no more than 10 minutes. They never left their machines until their relief took over.

"The loading and unloading time was cut by 50 per cent. When tools had to be changed, the tool setters had to *work*, because operators started passing remarks such as 'Get a move on!' 'Lord, how long?' etc. When the raids started girls would not go to their shelters, at any rate until the guns outside the factory started firing. And shelter time was lunch-time for them. Every operator stayed until his or her relief turned up—and in those days they might easily be two or three hours late."

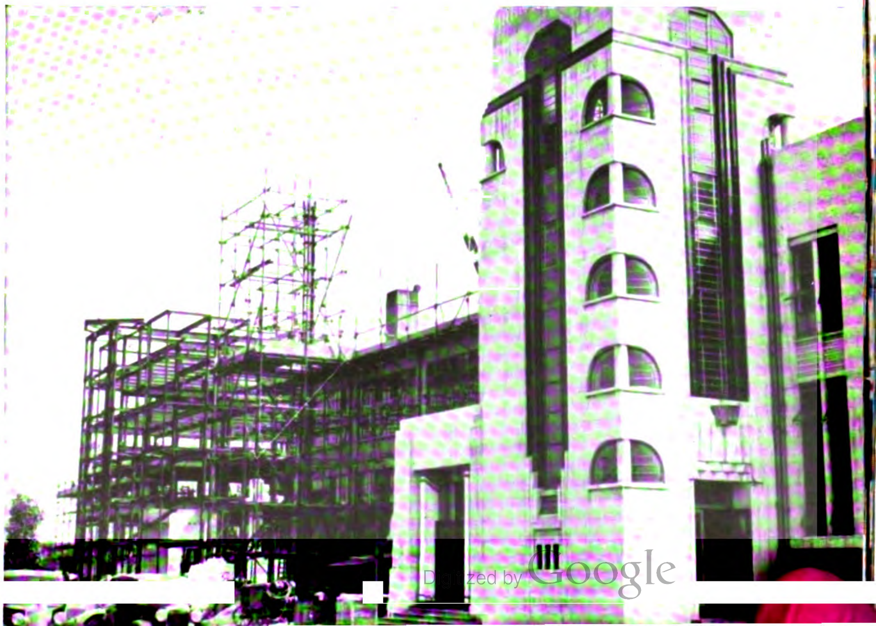
While existing factories and their workers were achieving this spurt and at the same time planning expansion and training new personnel, there was a corresponding acceleration in bringing many new units into production. In August 1940 the Minister of Supply told how a certain Royal Ordnance Factory, standing where the previous April there was only a green field, had been due to begin production in December. "In fact," he said, "machinery began to move in early in August, and what should have taken eight months was accomplished in four." There was, too, a shell factory which turned out its first test shell late in June. Normally that factory would have done well—very well—to produce 1,000 shells a week in August. It was producing 3,500.

The Dunkirk spirit spurred these people to make a supreme effort; it also inspired many others to seek ways to help to overcome delays. One Sunday morning in the summer of 1940 a war factory found there was so much material to be got out that the normal labour could not possibly handle it and there was danger of a hold-up. The labour manager himself organised a squad of Birmingham business men with a couple of his own directors, and they turned in and did a full day's work.

The ability to adapt and improvise was invaluable at the crisis, and it was remarkable the extent to which expedients led up to large-scale organisations while still delivering immediately-needed goods. An interesting example came from within the Army itself, and an officer and six privates of the Royal Army Ordnance Corps were responsible for setting on foot a movement which at the time made an important contribution to our re-armament and since then has saved war industry many millions of man-hours and tons of material.

After Dunkirk, R.A.O.C. depots were cluttered up with masses of broken, damaged and out-of-date stores. These seven men had all been in business before the war, and they knew that if manufacturers had to undertake repairs to goods they had made earlier it would cause delay and disorganisation of urgently-needed new production. They also knew that there was a big reservoir of garages and " back-street " workshops which had then very little part in the war effort, and they persuaded business acquaintances to help them find concerns that were able to handle their repairs without interfering at all with Ministry of Supply contracts. From this small beginning has grown the Central Repair Depot of the R.A.O.C., where hundreds of thousands of pieces of equipment that might never have been used again have found their way back into service. Sixty per cent. of the articles repaired are in first-class condition within a month and are placed into store for re-issue.

The flexibility of the small and medium-sized unit, to which reference is made later, made such organic development much more practicable than would otherwise have been the case, but as the stubborn reaction of the British people to the threat of extinction produced the Dunkirk spirit, so also the national aptitude for efficient industrial organisation, the tradition of skill, made possible Britain's rapid achievement of steady large-scale output.



Great modern factories have sprung up and extensions have been made to thousands of existing factories, to provide the floor space needed to make the weapons of victory.

"... the management had already organised turners, fitters and labourers into squads ... to clear up the debris and salvage as many machine tools as possible."

2. BRITAIN CARRIES ON

> *" I have myself seen a factory working at 90 per cent. of capacity while part of it was still on fire."*
>
> THE RT. HON. OLIVER LYTTELTON, August 1942.

> *" When the fierce attack took place on that town (Coventry) we calculated that it would take us several weeks to get the show going again. . . . When the attack took place roughly* 80,000 *people were working in that district. Notwithstanding the destruction, it took only fourteen days to get* 77,000 *back to work."*
>
> THE RT. HON. ERNEST BEVIN, July 1942.

IN a factory in one of the badly-blitzed areas the following notice was posted: " During the past three months 160 of our box factory employees, some travelling from the other side of the river, some from suburbs twelve miles away, and some having to make four changes en route, mustered between them only 324 minutes late, or about two minutes per head spread over three months." That is an indication of what was achieved during the period when the transition to large-scale production was taking place in the midst of the assault by the Luftwaffe on Britain. After the R.A.F. had won the battle for mastery of the daylight skies, the attack by night—first the continuous battering of London and then the shorter, more concentrated raids on other towns—was defeated by the people and by the organisation of Civil Defence. Without the efficient fighting of fires, the rescue of victims, the feeding and housing of the homeless, the maintenance of transport and public services, production could not have been kept going. Much of the story of Civil Defence has been told, but there are two points which may be stressed here; first, that the workers in factories and offices, in addition to refusing to be demoralised, appreciated also the importance of doing their jobs and made it a point of honour not to let air raids interfere; secondly, that the organisation for getting damaged war factories back to work provided the necessary counterpart to the courage of the people.

At a works engaged on emergency repairs one of the workmen turned up promptly as usual the morning after a heavy raid on the neighbouring district. He started at 8 o'clock, which meant leaving home before the " all clear " had gone. He worked through the day until nearly 5 o'clock, when he asked his foreman rather diffidently if he might be excused from overtime for once. The foreman asked why, and it came out by degrees that his home had been completely destroyed the night before. He and his family were " quite all right, thanks." They had been lucky—in the shelter when the house was hit, and although they had to clear away some of the debris before they could get out, no one was hurt. They had been well looked after at the rest centre, but he had to leave his wife and kids there, and he would like to get back before the evening siren went to find whether they had anywhere to go for the night.

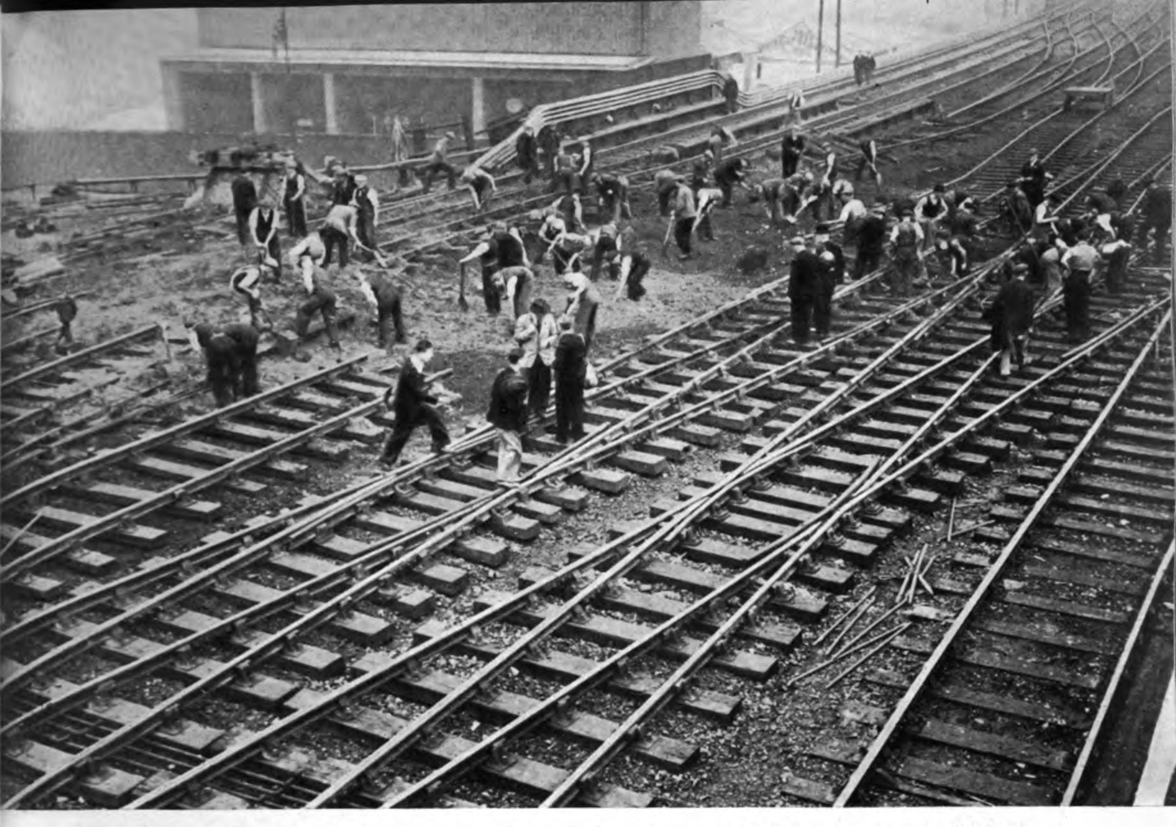
After the night's bombing, workers pick their way through the shattered streets determined that their war job shall not suffer.

That is the individual angle; it is paralleled by the way in which everyone did their best to ensure that bomb damage to factories interrupted production as little as possible.

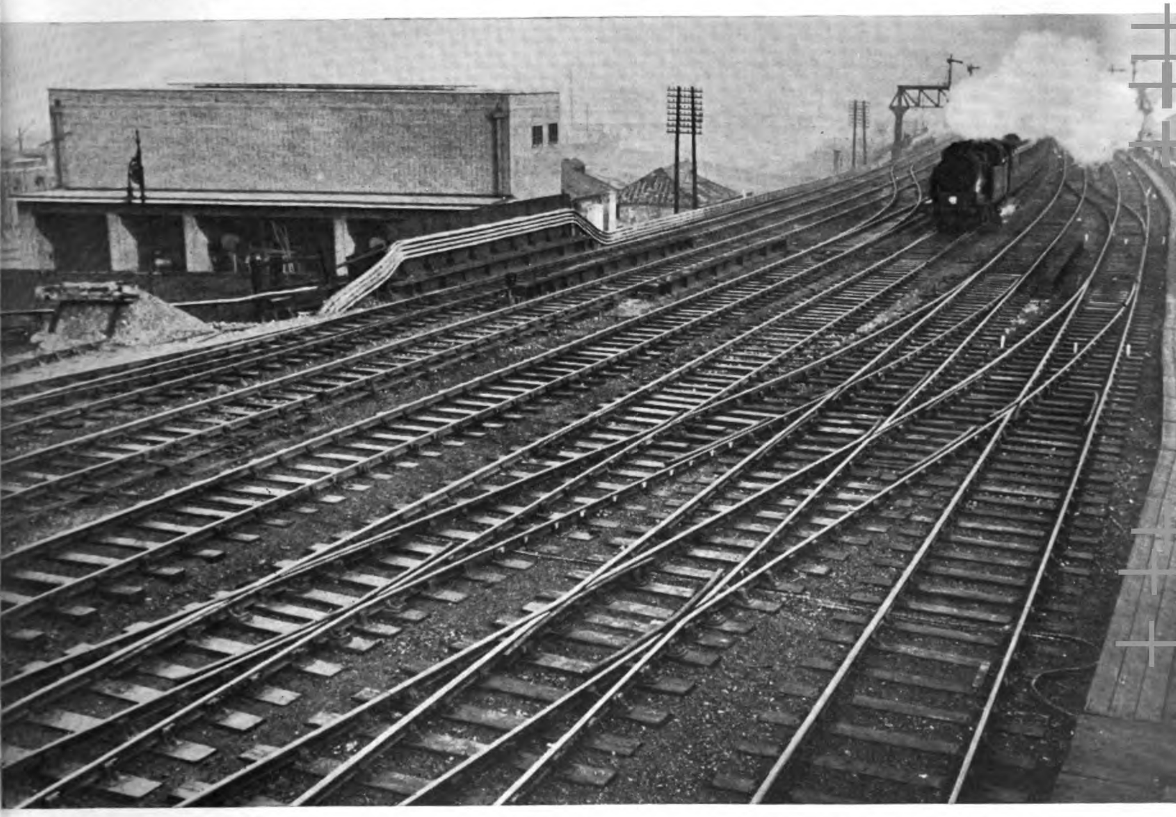
THE WORK OF THE EMERGENCY SERVICE ORGANISATION

The resiliency and determination to get going again on the part of management and workers could hardly have succeeded as it did without the help given by the Emergency Service Organisation, whose panels in each area, consisting of local industrialists working voluntarily, could bring to bear on the problem both the considerable authority with which they were vested by the various Ministries and the intimate knowledge of the district they themselves possessed. The example of an engineering works in one of London's central industrial areas is typical. After several narrow escapes the factory was squarely hit by a large high-explosive bomb during a night early in September 1940, but although some 400 local residents were sheltering in the reinforced basement, there were fortunately no casualties. The bomb penetrated the roof of a two-storey machine shop and burst on the ground floor, completely wrecking the shop and doing considerable damage to machines and adjacent buildings and plant. The shop was a steel-framed building with brick panels and Bridgwater tiled roof, and had been equipped with centre lathes, grinding and milling machines and other machine tools driven from overhead shafting. Hardly a machine remained intact; some were shattered or cut by bomb splinters beyond hope of repair and nearly all were buried beneath debris. The steel stanchions and bearers were cut or punctured by splinters. When dawn broke it looked an inextricable tangle of metal and building material and an almost hopeless task to tackle.

Within an hour of the incident a telephone call had been put through to the chairman of the local Reconstruction Panel at his home, and early the next morning he was inspecting the damage with the works manager and clerk of the works. By this time the management had already organised turners, fitters and labourers into squads, and these men, wearing steel helmets as some protection against falling tiles and bricks, were cautiously starting to clear the debris and salvage as many machine tools as possible, as well as useful plant, pulleys, small tools and work in progress. The first problem was cover, for by this time it had started to rain and, apart from the shop actually hit, windows and doors were missing and roofs damaged in adjacent buildings. The Reconstruction Panel member who had taken charge of the job at once issued a licence for the purchase of reinforced roofing felt, timber, corrugated iron and other essential controlled building materials. In those days the Emergency Service Organisation had not at its disposal the pool of tarpaulins that later helped so much to make factories usable and to save valuable machinery from weather damage,



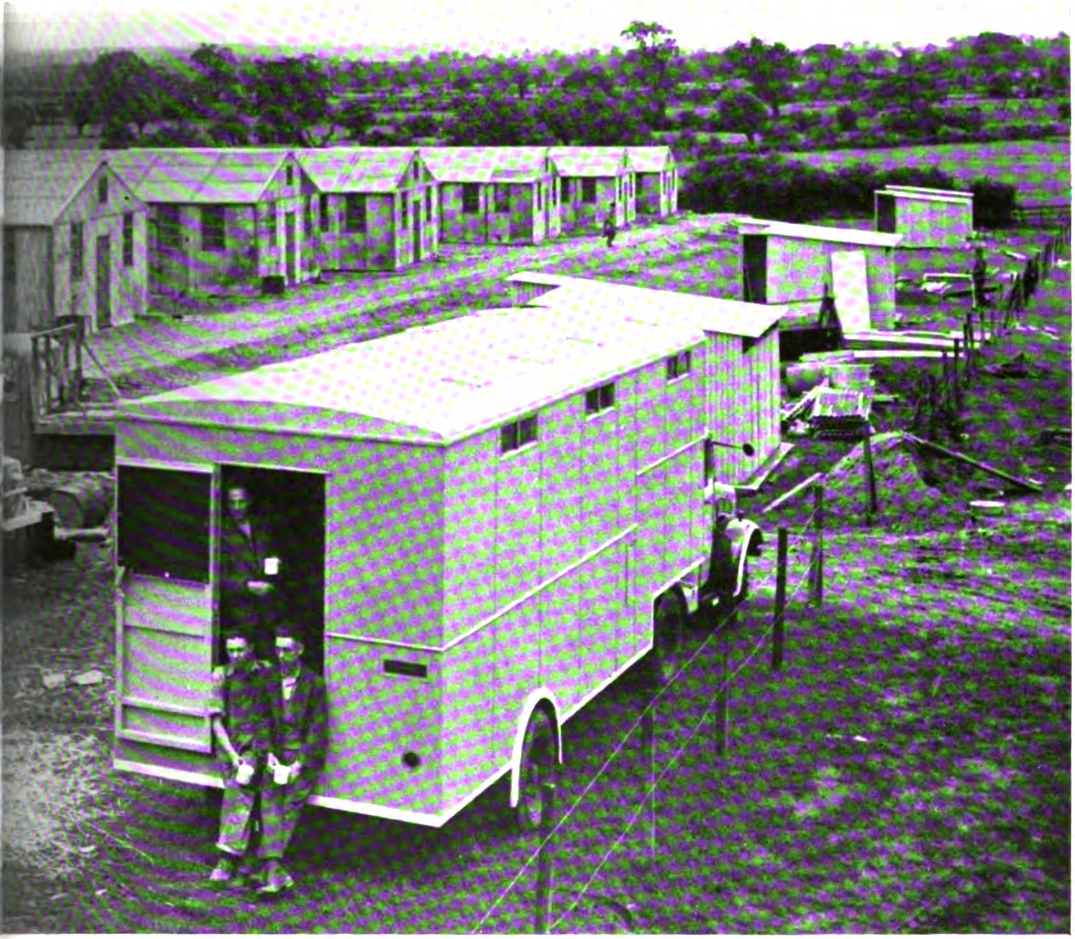
High-explosive bombs damaged the rails at the busy junction, holding up several traffic lines.



But the war workers must be carried to their jobs. So, 10 hours later, the lines are repaired and the workers' trains run through.

but various forms of covering were quickly made available to enable the other shops to carry on.

In the days that followed the shattered building was by degrees cleared of debris, steel stanchions were cut through with oxy-acetylene flame, machine tools were rescued from precarious positions on the first floor, main electric feeders were diverted, water mains reconnected, gas services repaired. And all these things meant a steady flow of requests to the members of the Panel for authority to obtain materials and for help in various directions, including, for instance, the securing of priority on labour. A list of a few of the services the Panel can call upon may give an idea of the work it helped to do. A broken telephone connection can be repaired through special facilities with the G.P.O., debris clearance for the rescue of valuable machines can be arranged through the Group Surveyor, squads of roof sheeters can be rushed to an urgent job, and special equipment, including electrical plant, can be loaned in the event of the breakdown of gas supplies or steam



Above : These pre-fabricated huts were erected in 10 days by men of a Flying Squad of builders. Efficient organisation of these mobile building units makes it possible to provide immediate accommodation for war workers under any circumstances.

Right : Another type of Flying Squad. These are skilled industrial workers who have volunteered to work in any part of the country where their services are specially required to reinforce local labour forces.

boilers, bomb disposal squads can be directed to a factory as a particularly urgent job, emergency transport can be provided and building licences granted under delegated powers from the Ministry of Works. It will be seen, therefore, that in a serious incident such as that described, the member of the Panel in charge had a big job to do. In this instance, first aid for the less seriously damaged parts of the works and repairs to all essential services were the first necessity so that the rest of the factory could get back to work. In fact, all the shops other than the one actually hit were in full operation again within two days, although a direct hit of this kind on a relatively concentrated island site had caused a great deal of general dislocation. The reconstruction of the shattered shop was naturally a much longer business, and for some time the member of the Panel was concerned with the licensing of the building work, including the provision of all controlled material, running into many thousands of pounds, before the new machine shop was finished, equipped and in full production.

Having shown something of the extent of work undertaken by a member of one of these local Panels in an individual case, it should be added that this was only one of many pressing jobs which, during the blitz period, he would have on hand. Every night then added to the list of damage. Yet all this work was entirely voluntary—the big contribution which these business men, selected for their ability to handle such matters and for their local knowledge, gladly made to the maintenance of production. In the case of the Panel in whose area this incident occurred the members then consisted of two directors of engineering works and a chartered surveyor of long standing in the locality. The Panel was formed about a month before it was called on to meet the emergency, the effects of which it did so much to mitigate. The use of leading local industrial representatives as the channel through which the resources and authority of the various Ministries could be brought to the task of getting damaged war factories to work again is characteristically British. The system worked well, and in fact the combination of Government authority and voluntary private executive

Above, right : Typical of the hundreds of small workshops in Great Britain which added their quota to the ever-increasing flow of war munitions. In this workshop one man and twenty-seven women were employed.

Below, right : Working under the supervision of the only man on the job, these women have become expert munition makers.

Left : Bomb damage in the workshop of an important war factory. This factory was damaged eight times in three weeks. The organisation of very rapid repairs made it possible to carry on with an amazingly low loss of output during the all-out air offensive on the British Isles.

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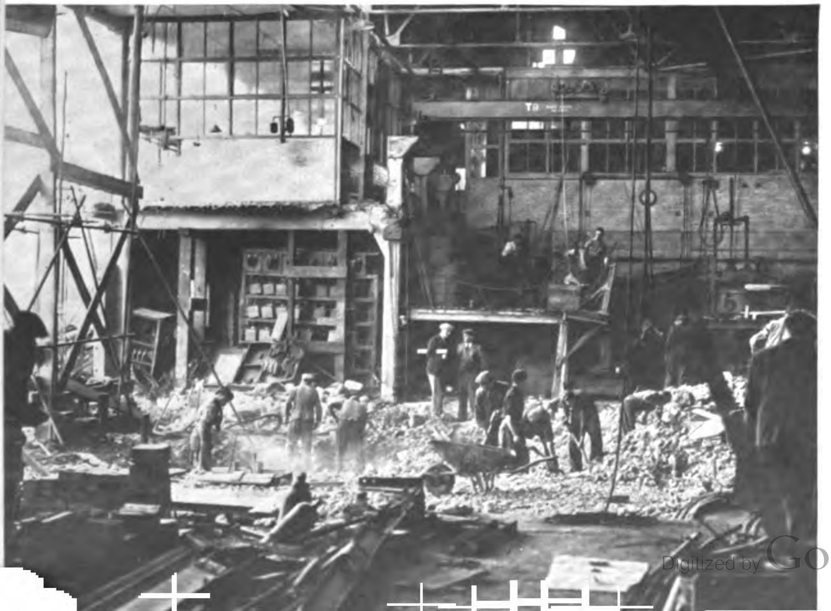
on the British Isles.

boilers, bomb disposal squads can be directed to a factory as a particularly urgent job, emergency transport can be provided and building licences granted under delegated powers from the Ministry of Works. It will be seen, therefore, that in a serious incident such as that described, the member of the Panel in charge had a big job to do. In this instance, first aid for the less seriously damaged parts of the works and repairs to all essential services were the first necessity so that the rest of the factory could get back to work. In fact, all the shops other than the one actually hit were in full operation again within two days, although a direct hit of this kind on a relatively concentrated island site had caused a great deal of general dislocation. The reconstruction of the shattered shop was naturally a much longer business, and for some time the member of the Panel was concerned with the licensing of the building work, including the provision of all controlled material, running into many thousands of pounds, before the new machine shop was finished, equipped and in full production.

Having shown something of the extent of work undertaken by a member of one of these local Panels in an individual case, it should be added that this was only one of many pressing jobs which, during the blitz period, he would have on hand. Every night then added to the list of damage. Yet all this work was entirely voluntary—the big contribution which these business men, selected for their ability to handle such matters and for their local knowledge, gladly made to the maintenance of production. In the case of the Panel in whose area this incident occurred the members then consisted of two directors of engineering works and a chartered surveyor of long standing in the locality. The Panel was formed about a month before it was called on to meet the emergency, the effects of which it did so much to mitigate. The use of leading local industrial representatives as the channel through which the resources and authority of the various Ministries could be brought to the task of getting damaged war factories to work again is characteristically British. The system worked well, and in fact the combination of Government authority and voluntary private executive



Above, right : Typical of the hundreds of small workshops in Great Britain which added their quota to the ever-increasing flow of war munitions. In this workshop one man and twenty-seven women were employed.

Below, right : Working under the supervision of the only man on the job, these women have become expert munition makers.

Left : Bomb damage in the workshop of an important war factory. This factory was damaged eight times in three weeks. The organisation of very rapid repairs made it possible to carry on with an amazingly low loss of output during the all-out air offensive on the British Isles.

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control has produced a flexibility, initiative and speed of decision which could not easily have been achieved otherwise. As conditions have changed, there have been progressive modifications in procedure, but there is no doubt that the organisation, whenever it is called upon, will do its job as well again as it has in the past.

There were innumerable examples from all over the country of the way in which factories maintained a high proportion of their output in spite of serious damage. There was one big works in a target area that had been hit many times. The fact that a whole range of stores had been burnt out and that hardly a building remained unscarred had not reduced output materially. Finally a big bomb landed in a shop containing three high-frequency electric furnaces. Two were completely wrecked, and the crater extended actually under the bed plate of the third. Three days later the furnace was working again, shored up with timber, surrounded by scaffolding and with a tarpaulin tent over it. In another factory blast shattered every pane in the glass roof of a big shop. The workers swept up the pieces and went on working. Then, before emergency covering could be put on the roof, it started to rain, and there was the remarkable spectacle of machines being operated with umbrellas over them to keep out the wet.

Two points of some interest emerged from experience of damage, the first more or less technical, the second pyschological. It soon became evident that in most factories, particularly those of one storey, it did not matter so much how hard a works was hit as where it was hit. Provided a few of the essential centres remained intact, all other difficulties could be overcome; and these vital points constituted a comparatively small proportion of the area covered by the buildings. Secondly, as works managers all over the country will testify, air raids on any locality were the most effective guarantee that everyone would work their hardest, improve their time-keeping and forget their grievances. In a Midlands factory that was hit, for instance, output for the week in which the incident occurred was only a fraction below normal; it was up by a third the following week.

To sum up, the main factors that enabled war industry to beat attack from the air were the spirit of the people, the ingenuity and enterprise of management and workers, the efficient organisation of repair and the success of Civil Defence in dealing with human as well as material problems.

Above, right : Millions of Britain's women have gone to work in war factories. This girl has been trained as an engineer's draughtsman.

Below, right : Meanwhile, Britain's skilled workers, who cannot be spared for the armed forces, do their fighting on the industrial front.

" A British soldier was standing on the jetty of an overseas port ... he examined a bundle near him and recognised the trade mark on it ... "

3. BIG AND LITTLE

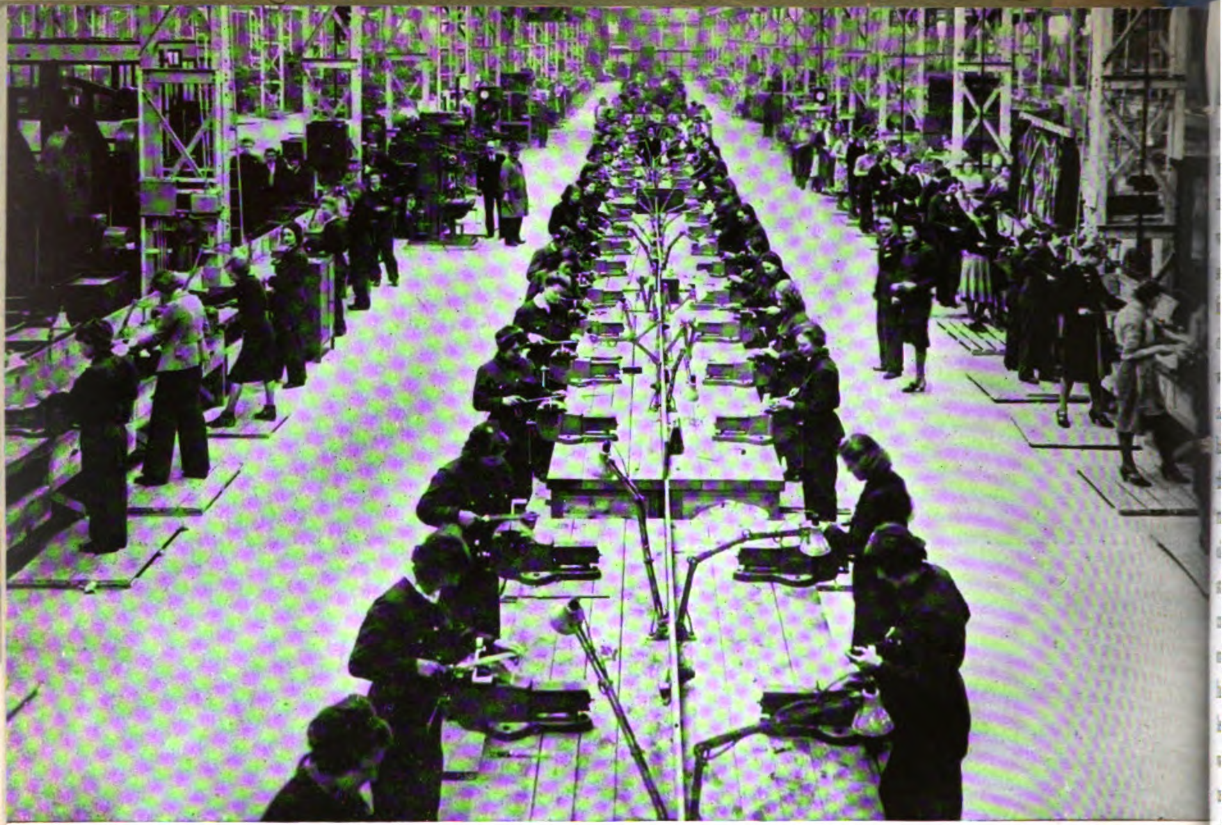
> *"One (aircraft) plant which used to occupy a single site is now scattered over five counties with 42 separate centres of production."*
>
> THE RT. HON. LORD BEAVERBROOK,
> then Minister of Aircraft Production, April 1941.

> *"In the engineering group of industries . . . out of a total of some 27,000 firms all but 1,000 are firms which employ 500 workpeople or less. About 63 per cent. of the total labour employed is in the 1,000 big firms."*
>
> THE RT. HON. OLIVER LYTTELTON,
> Minister of Production, March 1942.

IN addition to the large units, there has always been in British industry a multitude of small and medium-sized concerns, and these have contributed greatly to Britain's war production. According to the Factory Inspector's report, 57 per cent. of all workers in factories in 1936 were employed by firms with 250 or less on their pay roll, while only 16 per cent. were in factories with 1,000 or more employees. This has helped Britain to resist air attack. As the President of the London Chamber said during the assault on London, Britain does not carry all her eggs in one basket. And that is not by any means its only value. The structure gives flexibility and the ability to increase quickly the production of those things that from time to time become urgently needed as the demands of war change; and it has helped the skill, industrial experience, inventiveness and initiative of the British people to play their full part. It is difficult for a huge factory, employing thousands of workers and planned for mass production to change the nature of its product, even slightly, without considerable dislocation; the organised, co-ordinated effort of many separate units has proved its adaptability.

In making the best use of existing small and medium-sized units the main problem has been the co-ordination of effort, and some remarkable results have been achieved in this direction. One good example of grouping came from an inland resort where there is a firm of motor salesmen with a repairing garage. At the beginning of the war, foreseeing a decline in their normal business, the directors turned their attention to the possibility of war work and set about bringing more than 100 small concerns in the district under their direction for the carrying out of Government contracts. This group proved capable of doing work of a value approaching £15,000 a week, or at the rate of £750,000 a year.

Two major difficulties were met in the early stages. First, those officially responsible, quite understandably, took a little convincing that such an organisation could tackle complicated components with the relatively simple machinery available. Secondly, the owners of the various workshops were almost equally sceptical of their ability and had to be shown just how they could do the job with their tools. Both these hurdles were surmounted. When a trial order was at



In a huge workshop, row upon row of women munition workers keep the torrent of war supplies pouring out to the armed forces.

length obtained, and fulfilled with a very high percentage of accepted work, there was no trouble in getting further contracts. When the comparatively complex product had been split up into its components and each small unit could see what was actually required of it, doubt soon gave place to enthusiasm, and the workmen showed great ingenuity and skill in finding improved methods to speed up output and secure accurate work.

It should be emphasised that the success of the scheme was primarily due to highly-skilled direction and organisation by men who realised the extent to which a job may be broken down and subdivided so that each simple tool—they were centre lathes for the most part—can work on a single process. And the parent unit provided the essential element of central control and cohesion. Similar stories of grouping have come from many different trades. For instance, 38 different concerns in the jewellery trade formed themselves into a group, with a council of five to buy materials, allocate work according to plant capacity and obtain contracts. Trained for high-precision craftsmanship, the 300 workers employed by the various firms have provided a valuable unit for the production of delicate parts for aircraft, ships, torpedoes, tanks and guns. One of the men working at the bench was formerly the principal of a concern that made jewellery for the court of Queen Victoria.

To take the matter a little further down, it is worth looking at one of the small shops which, as sub-contractor in a larger scheme, has played a useful part in production. In an old house in Kent there lives a family of artists and craftsmen who in war found little demand for the creative work they produced in peace. So they sought, and in the end obtained, contracts for small components within the capacity of the plant they had. They adapted their workshops to the job, obtained in due course some additional tools, and soon had a well-equipped little plant. Two of the brothers are mainly responsible for running the " works " situated behind the old red brick house in what were once the stables and coach house. One of them is concerned with contracts and general organisation for the most part ; the other, a highly-skilled mechanic with a good knowledge of tools and experience of munitions work in the last war, is what may be called the technical manager. They employ a number of people who live near and work there for a varying number of hours a week as part-timers.

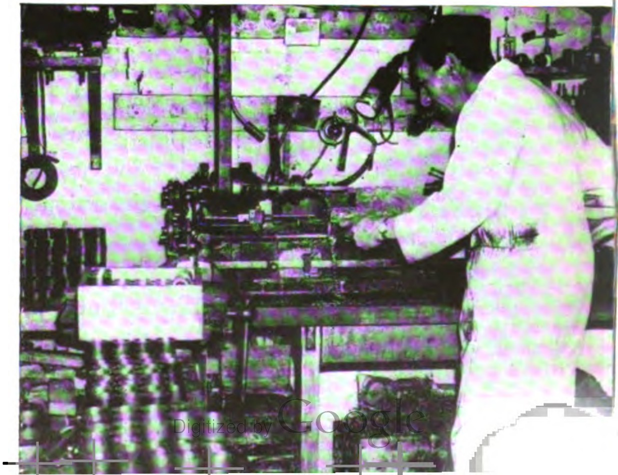
THE CHANGING PROBLEM

To-day, of course, the need for getting production somehow or other from inferior tools by adaptation and ingenuity no longer exists. In the earlier period, a shortage of machines was the main limiting factor. Good modern tools are available now, and man and woman power has become the chief problem. To-day, by what the Minister of Production calls " re-allocation," the aim is to keep the most modern plant going 24 hours a day to secure maximum output from the available labour and skill. This means that old or less suitable machinery may no longer be employed, operatives being transferred so that their work may be more productive. Contracts are being placed where they can be fulfilled with the lowest expenditure of man-hours and the greatest economy of material. Where factories, big or small, are inefficient, either their organisation and equipment must be brought up to date or their labour taken to produce under more favourable conditions.

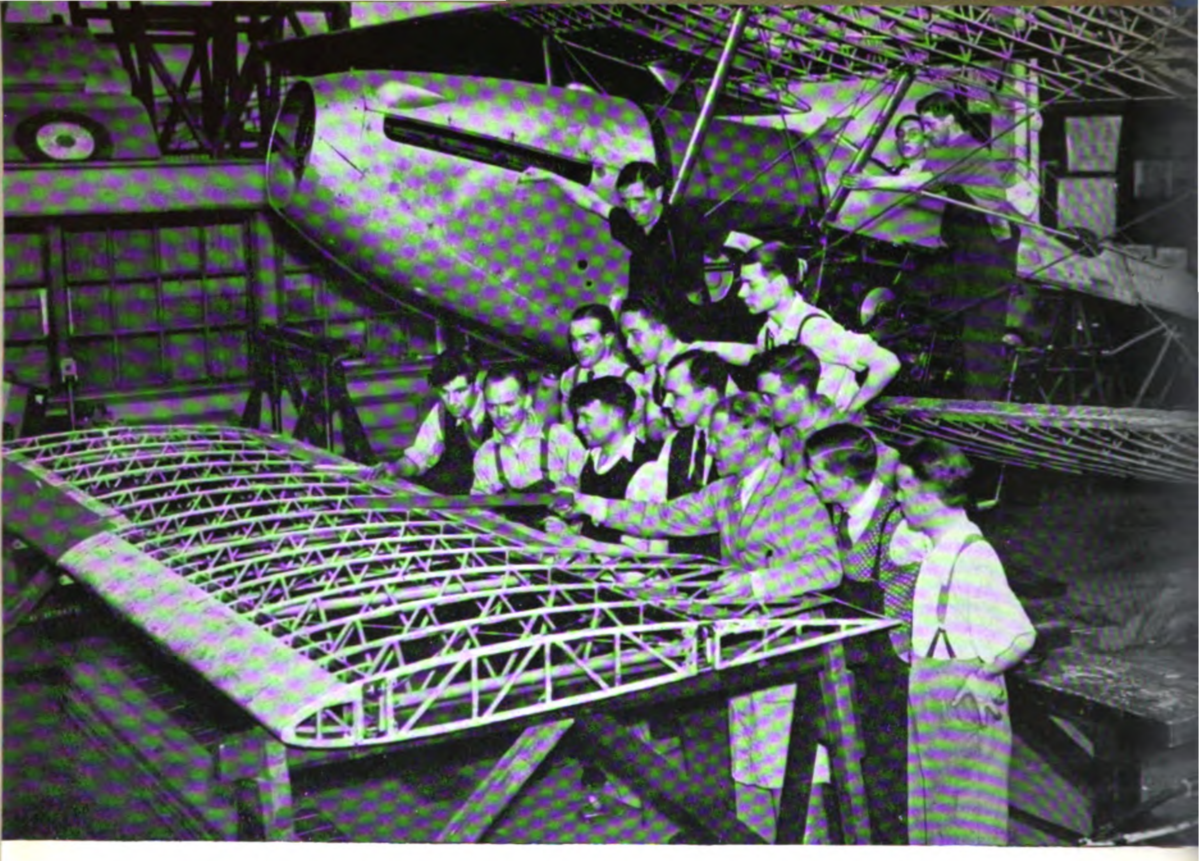
This does not mean, however, the end of the small concern, or of all such groups as those that have been mentioned. If they are inefficient, then they must go in spite of their past services, but in many instances where the work is suitable they reach a very high standard, and remain a useful part of Britain's industrial war machine. Although for many products the optimum size of the unit is necessarily considerable, an infinite variety of components which are needed to-day can be, and are being, made as well and as economically in the small shop as in the big factory.

INDIVIDUAL INITIATIVE SOLVES A PRODUCTION PROBLEM

The instances already quoted have involved for the most part the grouping of really small units ; the co-ordination of a number of medium-sized concerns has been an even more important element in production. The story in some detail of how a rush job for one of the services was handled through the initiative, enterprise, organising ability



Contrasted with the vast factory on the opposite page, this shows a retired shipowner doing his war job making shell caps in a private garage. Big factory and little workshop—both alike have played their part in Britain's great production effort.



Young apprentices, and older workers from many peacetime trades, have been rapidly trained as experts in aircraft construction. And now Britain's aircraft industry is the biggest single industry in the country.

and drive of a business man may serve to show the flexibility and adaptability of Britain's industrial organisation.

There is a concern in London which before the war made travel goods and certain special types of luxury sports equipment. One Saturday the Ministry of Supply rang up the managing director, whose name may or may not be Johnson, and asked him to attend an urgent conference the next morning. He went and met half a dozen officers and officials who explained that according to their information he was the only manufacturer of a certain type of equipment. They had one of his products there and told him they needed at least 100,000 of them in six weeks. Now this firm's maximum potential output was something like 5,000 a month, with luck, and no one else had any experience of this particular type of work. The officers said they realised these difficulties, but they must have the equipment and what could he suggest? Johnson asked for 24 hours to think it out, and went away. That was not a peaceful Sunday afternoon for him, but he was able to go back on Monday morning and tell them that he reckoned there were 60 other factories scattered over the country who might just conceivably be able to do the job, if certain refinements were dropped, if the materials were available, if the metal parts needed could be obtained immediately, and if he could teach them how to do it.

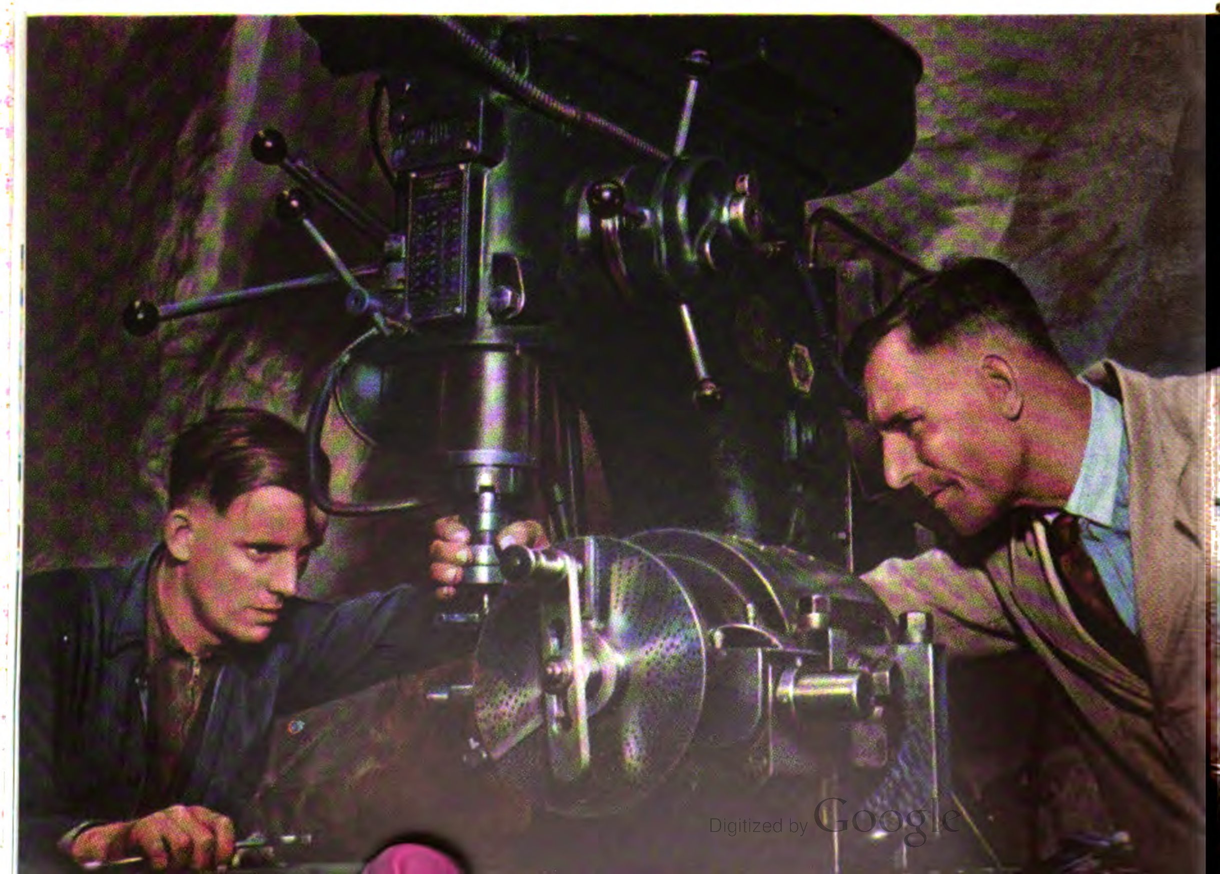
A meeting was arranged in the Midlands, a couple of days later, of representatives of the

60 firms concerned, and by that time Johnson had produced samples of a modified design, approved by the Service department concerned. He discussed these samples with the men there, telling them how the job would have to be done, what were the essentials and what machines could be adapted for the work. They went away to work out the problems in terms of their own plant and personnel. Johnson then saw three of the country's biggest makers of the small metal components needed in the equipment. They said that they might be able to start delivery in three months. But that hurdle was surmounted in the end when alternative materials and welding, instead of riveting, had been accepted as practicable. By the time Johnson was back in town information on stocks of material was available. He had to accept several modifications and substitutions, and all these points had to be communicated immediately to the 60 firms concerned. Nevertheless, three days later Johnson had fixed up subcontracts with 47 factories of various sorts and sizes, the metal parts, materials and fittings started to come in on time, and everyone got down to it. For weeks Johnson had to be a guide, philosopher and friend to 47 harassed works managers struggling with a strange job and working against time. He was at it all day and every day, but the equipment was delivered on time. This story was told in an Air Raid Warden's post at midnight when Johnson was halfway through his weekly night on duty. It had a sequel many thousands of miles away. A British soldier was standing on the jetty of an overseas port idly watching ratings loading equipment on to a naval craft. As he, too, had been in the travel and sports goods trade before the war he examined a bundle dumped near him and noticed the trade mark on it, which was that of Johnson's firm, with whom he had done business in the past. By a further coincidence he was sent home soon afterwards on a special job that took him to the Ministry of Supply. He mentioned the coincidence to the official he was seeing, who happened to be the man who placed the contract with Johnson!

PLANNED DISPERSAL REDUCES THE DISRUPTIVE EFFECT OF BOMBING

The existence in Britain's war industry of all these separate units constitutes in itself a considerable measure of dispersal, but the threat and experience of air bombardment made it necessary to secure such protection also, wherever possible, for the production of the big factories. This conscious, planned dispersal is best illustrated by an example. In one of the target areas in the Midlands there was a large works producing aero engines. In the summer of 1940 the management and the Ministry of Aircraft Production were both agreed that the risk of leaving the whole of the firm's productive capacity in one vulnerable unit was too great, and a conference was held in London to decide what was to be done. In considering where the new units could be placed and the type of dispersal to be aimed at, one of the first questions was whether

In order to fit themselves for an important war job, many British women have taken special courses, at their own expense, in Municipal Institutes. Here are trainees learning to be engineers in the machine shop of an institute in London.



or not shortage of management and trained office personnel made it essential to remain near enough for control to continue from the parent factory. In this case the firm said they could provide sufficient staff to establish a separate new factory which might be put anywhere in the country. The next thing was to find out from the Ministry of Labour in what areas there would be sufficient labour and on the basis of this information the North Western district was chosen.

In each region into which Britain is divided the Ministry of Aircraft Production have men whose job it is to find buildings for factories—they are usually architects or surveyors. The officer for the North West Region was consulted and particulars were prepared of the number of units in which the new plant would be housed, the size considered most suitable, the amount of labour needed and its type, the power required and a hundred other items. Some disused cotton mills were chosen as suitable for adaptation, as the weaving shed provided the right sort of floor space for the machine shops, whilst the two-storey buildings usually standing beside the sheds could be used for stores, works canteens, etc.

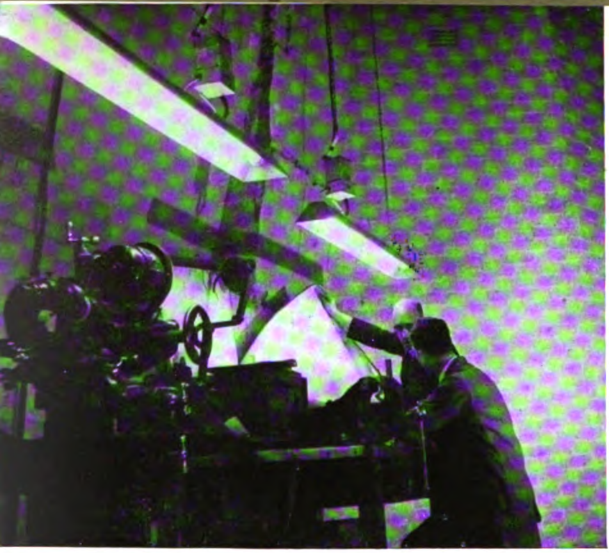
The buildings selected, which for the most part had a floor space of not more than 100,000 ft., were themselves dispersed over a considerable area within the district. They were requisitioned by the Ministry and the firm was immediately licensed to take possession. The next stage was the planning of lay-out and of the necessary alterations and repairs. This was very rough-and-ready because there was no time to waste and, as soon as some idea of requirements had been obtained, the firm started on the job. The buildings were cleared; roofs were mended; the floors of the weaving sheds, worn into grooves and unsuitable for taking machinery, were broken up, the rubble used as hard core and a new concrete surface floated on; A.R.P. provision was made.

In the meantime the provision of the necessary machines was planned. Some would be moved from the parent factory, but a great deal of balancing plant is always necessary in such cases because it is impossible, for example, to divide one grinding machine in the parent tool shop into two. At the same time labour was being engaged, and as soon as one shop was complete some plant was installed so that training might start under the skilled men brought from the Midlands. The nucleus, both in the shops and in the office, did not need to be very large, for it was possible to recruit a good many people with suitable qualifications in the dispersal district. Not only operatives but engineers and draughtsmen were found who could quickly adapt themselves to the work.

By this time the new factory, with its equipment and organisation, was beginning to take shape, and it then became necessary to plan the actual move in detail so that the flow of production should be interrupted as little as possible. The speed with which such a dispersed works could start production was not always an index of the energy and good work put into the job, because demand for the product was sometimes so urgent that not even a very temporary reduction of output could be allowed—for all this was in the grim days of 1940. In some cases the change over was achieved with amazingly little disturbance. One factory, dispersing to no great distance, moved virtually machine by machine, the workmen going with their plant, and it was

Above, left: Here is one of Britain's war workers taking his family for a Sunday walk over the factory where he works during the week.

Below, left: Here is a scene in the factory. It is deep underground, concealed, and safe from any bombing attack. Britain has many such underground factories in operation.



In one of Britain's underground factories the shop superintendent gives orders for the day's work.

This shaft, down which a crate is being lowered, gives an idea of the depth of the workshops from the surface.

The air in this underground factory is changed five or six times a day. A grinder at work.

No bombing could disturb the progress of the work that is carried on, day and night, in Britain's underground war factories.

reckoned that only half a shift was lost in the move. Another very big job was the organisation of transport between the various dispersed units of the new factory, so that material should be delivered to the shops as required and finished parts passed on for assembly. And this traffic had to be planned to secure maximum economy and assure wherever possible that each lorry or van had a return load. Altogether such a move as this, carried out under the spur of great urgency, was a headache for those who had to accomplish it, but the difficulties were overcome by goodwill, co-operation and hard work.

The example chosen represents only one type of dispersal. If there had not been sufficient managerial staff to control a complete new factory, then the dispersed units would have been relatively near the parent firm; where the works had already been damaged by air attack, the problems would be rather different; for certain types of production the erection of new buildings might be necessary. But all dispersal had some common characteristics: the splitting was vertical and the object was to assure that if one building, or group of buildings, was hit, at least a proportion of output would continue. The British aircraft industry is in any case organised on a sub-assembly basis—it is very rare for all the parts of an aircraft to be manufactured and put together on one site—and, with the added protection of a vigorously conducted dispersal programme, it survived attack with remarkable success.

Although it enjoys the advantage of using many smaller concerns, British industry is capable of organising units on the largest scale, and for certain purposes this type of factory is inevitable. A steel works and rolling mill, for instance, cannot well be split up into many dispersed sections. The Royal Ordnance Factories offer perhaps the most striking example of a vast organisation specifically created for war purposes and put into operation with remarkable speed and success. There were only a very few of these factories before the war; to-day there are over 40, employing 300,000 men and women. One factory alone turns out a number of guns equal to 75 per cent. of the monthly total produced throughout the whole country in the last war when output was at its peak. The personnel of some of these factories ranges between 10,000 and 25,000. That is the large-scale side of the British war effort.

There is one other example that illustrates both British ability to work in a very big way as well as in small units, and also another aspect of protection from air attack. Although not a great deal has been released about them, there are in this country several vast underground factories producing aircraft components. Descriptions published some time ago stated that one of them covers an area of several square miles and employs several thousands of men and women. It was evolved from a disused quarry and it was necessary to remove about a million tons of loose stone before a survey could be made and the lay-out of the factory planned. On its construction 8,500 men were employed and the accommodation was to include six hostels.

In another subterranean factory, 61 per cent. of the workers are women, who take an equal share of the night shifts with the men. This factory has been in operation long enough to prove that given the right conditions underground war production is practicable even for the making of delicate aircraft parts. The degree of accurate planning, the application of scientific knowledge and first-class organisation needed to make a success of such an undertaking says a great deal for the quality of British industrial brains.

Here is a craftsman who, in peacetime, worked in a London jewellers and silversmiths. Instead of fashioning precious metals or setting rare gems, his sensitive fingers are now engaged on the delicate precision work needed for certain gun components.

"There is a retired colonel, aged 56, who gave up his Yorkshire estate ... and is now chief storekeeper in an aircraft factory: the manager of a music publishing house is an inspector and viewer, a professional golfer is on bench fittings, a diplomat, aged 61, is an inspector, and a jockey is a machine operator."

4. MAN AND WOMAN POWER

" *We have factories making guns—big guns—which are manned and I use the word deliberately, as to over 70 per cent. by women.*

" . . . *A great proportion of these women had never been in a factory two years ago.* . . ."

THE RT. HON. OLIVER LYTTELTON, August 1942.

" *Precision engineering jobs which a few years ago would have made a skilled turner's hair stand on end, are performed with dead accuracy by girls who before the war had no industrial experience.*"

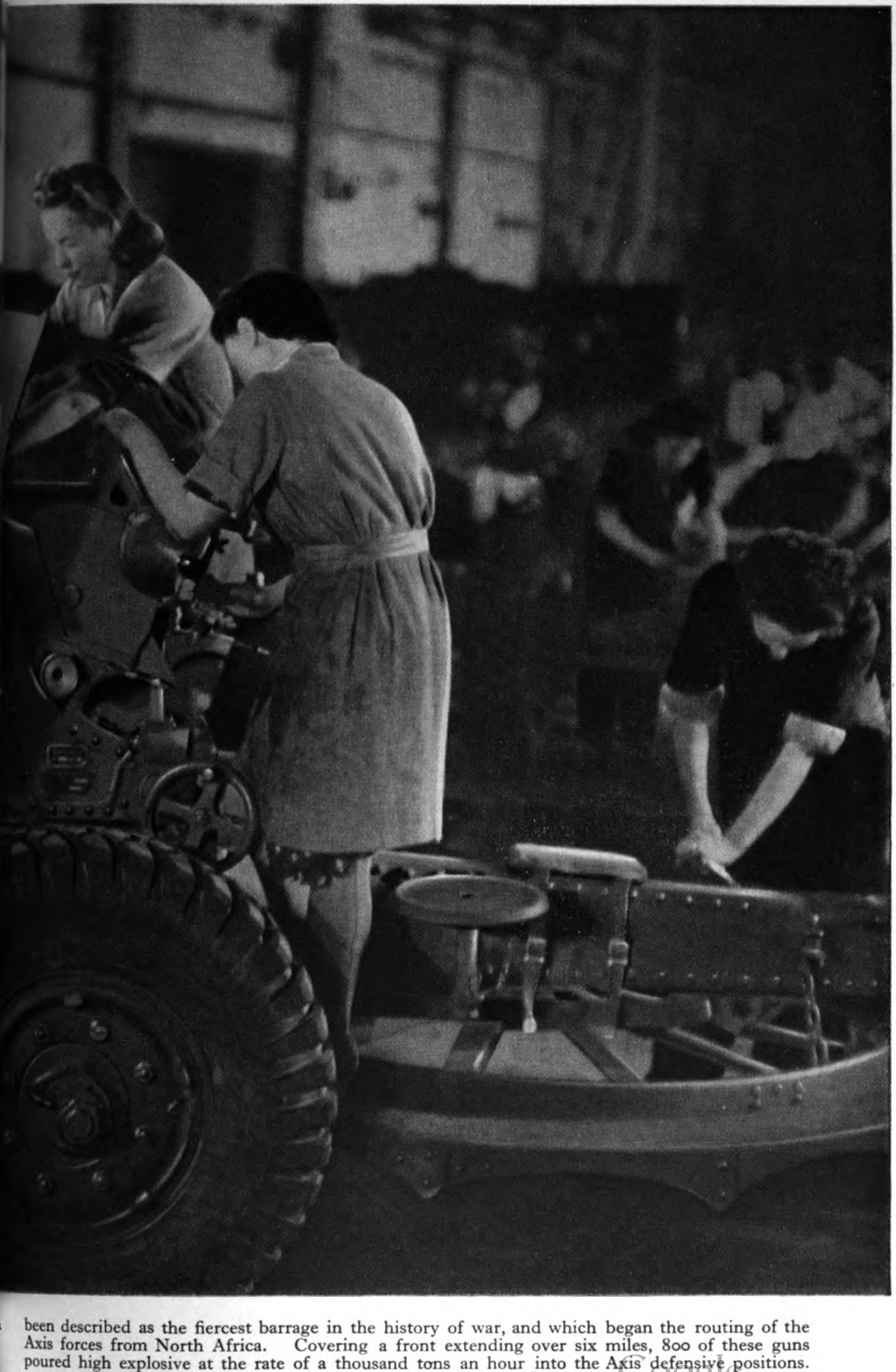
THE RT. HON. SIR WALTER CITRINE, September 1942.

THE output per head in Britain's war industries is the highest in the world. That has been achieved when practically all the younger workers are serving in the armed forces, and with employment of unprecedented proportions of women and others formerly unskilled. Of the 300,000 people employed in the Royal Ordnance Factories, 60 per cent. are women, 32½ per cent. semi-skilled or unskilled men, and only 7½ per cent. skilled men. These generalisations are impressive enough, but they do scant justice either to the initiative and adaptability of the worker or to those whose job it is to organise the industrial effort.

Steel manufacture is one of those heavy industries that would seem to offer practically no jobs for women, and its vital importance might well have been taken as sufficient justification for retaining all the men needed. And in this unlikely industry the most unlikely place of all is the melting shop. Here the scrap and ore come in, are fed into the furnaces, flow out a white-hot liquid, and then are teemed into the moulds from which emerge the ingots of all those different steels that make modern war possible.

Come into the melting shop of one of Britain's biggest steel works. It is a huge, lofty building with a long stage on which the furnaces stand, running down the middle a quarter of a mile long. The shop, covered in as far as possible for blackout, seems dim and vast, with a dull glow of hot brickwork brightened every now and then by the glow of an opened door or a brilliant cascade of molten metal as a furnace is tapped. In the distance stand the red hot ingots cooling off. An infernal setting where one hardly expects to find women at work. But, in the scrap yard, nevertheless, you will see girls high up in the overhead cranes and, down below, handling the material. On the stage, others are unhooking the chains as the boxes of scrap and ore are delivered ready for the furnaces ; weighing out the various materials that must go into the different steels ; working the dolomite mill ; preparing in the laboratory, right by the furnaces, the specimens for testing ; doing all the labouring jobs about the shop ; dressing and laying bricks.

THE FAMOUS BRITISH 25-POUNDER: A team of girl workers in one of Britain's war factories at wor
on the final assembly of a 25-pounder gun. The 25-pounder, with its devastating rate of fi
and its range of eight miles, played a great part in the historic barrage at El Alamein which h



been described as the fiercest barrage in the history of war, and which began the routing of the Axis forces from North Africa. Covering a front extending over six miles, 800 of these guns poured high explosive at the rate of a thousand tons an hour into the Axis defensive positions.

There are 150 women employed on three shifts in this shop alone.

This big woman in dirty overalls, with a cap covering her hair, is now a brick dresser. Her age is about forty, and she has two sons in the Services. Early in the war her husband had an accident in the street which resulted in the amputation of a leg. There was some delay in compensation until the extent of his disability could be assessed, and his wife decided that she would go out and earn. The Labour Exchange sent her to this steel works, where she was first interviewed by the woman responsible for the employment and allocation of all the female labour, who explained the jobs that were available and discussed them in detail with her. She was willing to try being a labourer in the melting shop and started in there immediately. That meant that she had to do all the odd jobs required—fetching and carrying, sweeping, tidying up. Her progress was watched and it was soon decided that she was a reliable and careful worker who could be trained for something more responsible. One of the skilled men she had to keep supplied with oil reported that he had never had better help and that she beat most men at the job.

It was decided about this time to try women on brick dressing—that is, cleaning the bricks when the furnaces are rebuilt—and this woman was asked whether she would like to be trained for that. She was keen, and, learning very quickly, is now regarded as a thoroughly skilled worker. It is a dirty job and hard on the hands, but not as bad as another she did one week-end. On a Saturday afternoon volunteers were wanted for cleaning out the soot from under the furnaces. The soot is hot, and any abrasion the worker receives tends to become septic. There was a shortage of men, and this woman volunteered to do the work. The pay was good and she was putting the money towards the artificial leg that was being made for her husband.

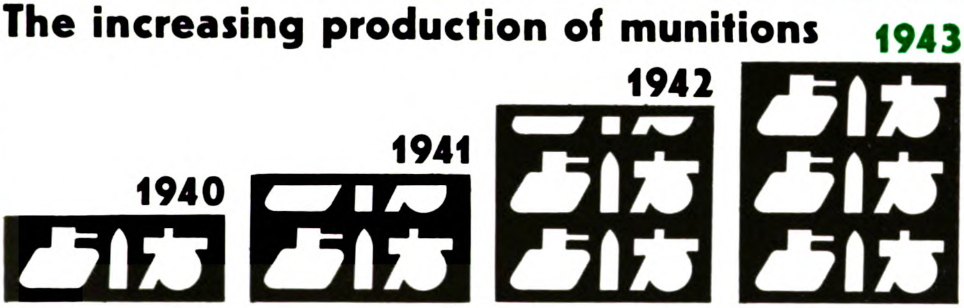
Going on through the miles of other shops, women seem to be everywhere. Nearly all the crane drivers are girls—they say here that the under thirty-fives are better at this job and do it very well indeed ; girls watch the gauges by the soaking pits where the ingots are reheated before going to the cogging and rolling mills ; girls operate the controls that bring the hot bars on to the cooling beds. This one was a bus conductress before she came here. She began work as a paint girl, rather an unpleasant, smelly job, and if she is lucky may finish as a checker, the most highly-paid work for her here. They said checking could be done only by someone who had grown up in a steel works and knew almost by instinct the different kinds of steel. But the woman supervisor, who is an enthusiast, and does not really believe there is anything women cannot do, got permission to try teaching girls the work, and the experiment was wholly successful.

That is a very brief indication of some of the many jobs that are being done by women in one of the most unlikely places. In this works there are altogether a thousand women where there were none before the war. More than 80 per cent. of them are married, many are well over 40, and all are doing a grand job of work for the war effort.

Over the whole of war industry the range of the jobs being done by women is too wide even to attempt a summary. From girls of sixteen to women over sixty they are carrying out, according to their ability and aptitude, nearly all kinds of men's jobs, except those involving sheer physical strength or very high skill and experience. And the limits imposed by those factors seem more and more elastic. The younger women—"typist becomes skilled mechanic," "from beauty parlour to lathe"—not unnaturally find their way more readily into the news, but the older ones are doing at least as much.

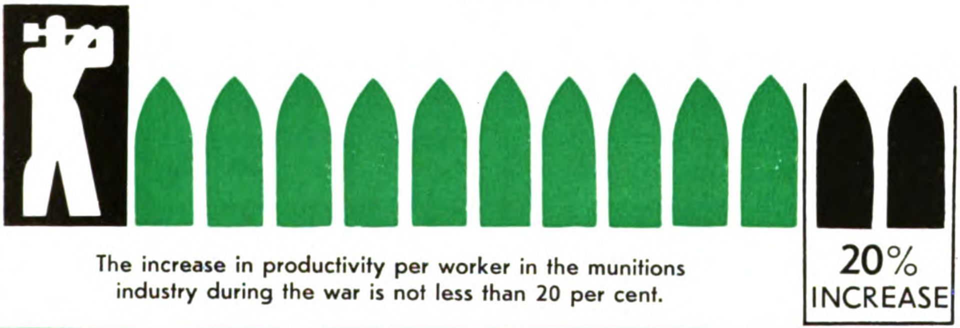
FACTS AND FIGURES GIVEN BY THE BRITISH MINISTER OF PRODUCTION

The increasing production of munitions



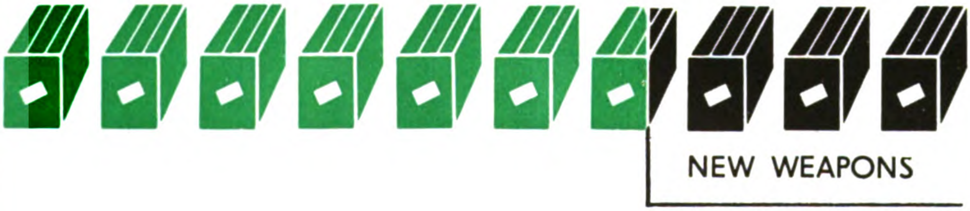
Measured statistically the production of munitions has risen approximately as follows: 1st half of 1940, 100; 1st half of 1941, 150; 1st half of 1942, 230; 1st half of 1943, 300

Increase in productivity per worker



The increase in productivity per worker in the munitions industry during the war is not less than 20 per cent.

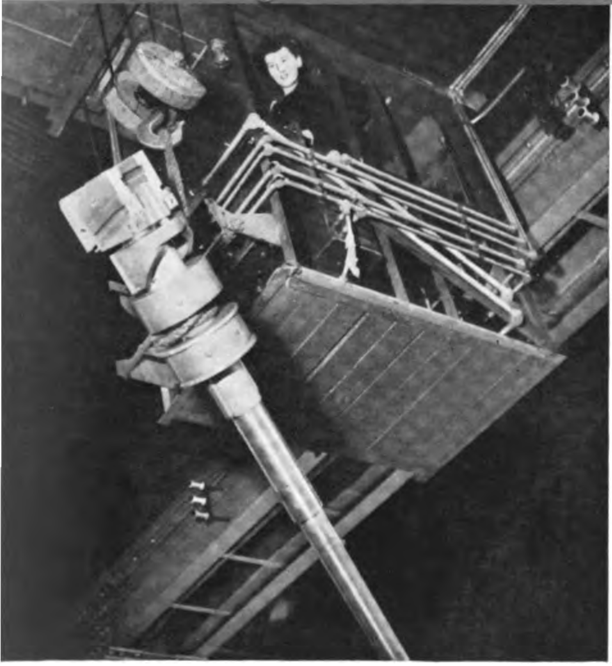
33% of production on new weapons



About 33 per cent. of production now is engaged on turning out weapons which did not exist, except in the imagination of their inventors, when war broke out

"*We are devoting sixty-five per cent. of our man-power directly to the war; I think, a higher proportion than has ever been attained by any country in history.*"

MINISTER OF PRODUCTION, *August, 1943.*



The crane driver, skilfully manipulating this big tank gun, is a girl of only 17. She came straight to the job after leaving school.

One of the big armament factories in the Midlands has stated : " We have some over-sixties in the machine shops—some doing whole-time, some part-time. Machinery does not seem to worry them. . . . We find that when a woman gets to that age she has the war effort at heart. She doesn't come simply because she wants the money." A report from a Birmingham Labour Exchange says that many of the older women in the Birmingham area have been in the factories before and know what to expect. " Many are willing to stand at machines all day. Others who are not so strong we submit for lighter jobs. A woman over 55 wouldn't normally go on a machine. . . . There is also the older patriotic type who has not been in a factory before. Their new life may not be easy and they come back to the Exchange sometimes and say they can't stand it ; but often they have another try and settle down. A typical case was that of an intelligent middle-aged woman who came in. . . . She was put on a capstan and did so well that after a short time she was given the heaviest capstan in the shop and was doing a man's job. Later, she considered whether to leave because her hands were blistered, but she decided to go on trying and she is still there."

OFFICE WORKERS AND PROFESSIONAL MEN BECOME SKILLED MACHINISTS

It is not only women who have acquired new skill and taken on strange jobs, for many thousands of men have been transferred from non-essential to essential work. Wherever possible they are put to something that suits them, and as near as may be to what they have done before. But in a great many cases that is not practicable, particularly where black-coated workers take their place on the factory floor. The contrasts are often spectacular. There is a retired colonel, aged 56, who gave up his Yorkshire estate, lived in a council house while training for factory employment, and is now chief storekeeper in an aircraft factory ; the former manager of a music publishing house is an inspector and viewer ; a professional golfer is on bench fittings ; a diplomat (61) is an inspector; a jockey is a machine operator; a missionary is now a toolmaker ; a librarian turns instrument maker, and so on. These men succeed in making the revolutionary change in their way of life mainly because of their keenness and general intelligence, but that alone is not enough. The fact that so many rapidly become skilled workers reflects a great deal of credit not only on the men and women themselves and the factories into which they go, but also on the way they are taught their new trades. Many, of course, go straight into the factories to do relatively unskilled work, and many are taught on the job. But others who are suitable go to a technical college or to one of the big Government training centres, where getting on for a thousand men and women at a time may be in training. The procedure and organisation follow works practice as closely as possible —there are three shifts a day to make the fullest use of facilities—and not the least useful feature of the training is that it accustoms those who have never been on the factory floor to the necessary routine and discipline. But the friendly atmosphere, the desire for knowledge and the relation between instructor and instructed is more reminiscent of a university. All sorts and conditions of people come here. They are carefully sorted out according to their capabilities, given a training varying from the short course of eight weeks to the full course of sixteen weeks, and then placed in jobs in the war factories.

TRAINING THE RESERVES OF LABOUR FOR THE FACTORIES

The most difficult step of all is probably the first. A professional man, or a shop-girl, a married woman, a gardener or a salesman comes into these surroundings feeling very strange and probably knowing little or nothing of machines or machinery. How are they started on the path to becoming skilled workers ? Down at the far end of the main shop there is what they call the " nursery " where the instructor is teaching a class of new entrants destined to operate lathes or milling machines. He is a middle-aged man, an enthusiast and a natural teacher. How does he start ? Well, first of all he talks to them about safety—to keep their hands clear of running machinery and belting, not to wear loose clothing that might get caught up, and points like that. It is surprising how necessary this is with people new to a workshop. Then with a large blue print, he teaches them the parts of a lathe, and gives them some instruction in elementary workshop mathematics. From this he goes on to teach the use of a micrometer and some simple instruments. After that they are allowed to walk round the shop and watch more advanced trainees at work, with the instructor always available to explain and answer questions. In a few days, he says, they have got the feel of the place and are ready to start on a lathe or shaping machine doing

In contrast with the young worker on the opposite page, here is a 51-year-old married woman operating a capstan lathe. She has a son in the British Army and two others in the Home Guard.

very simple jobs. Those two girls over there have only just begun on that old lathe, and it looks as if they are in difficulties. He crosses over and puts them right. It isn't long before they are turning out quite respectable work of a simple kind. The instructor proudly produces several specimens. The man who did this—it is hardly perfect but not too bad a job—had only been a week in the place. He turned out a first-class workman. He had been a gardener before; now he is doing a really skilled machine job in an engineering works, and is very pleased with himself. His teacher produces a letter he received from the former pupil only a day or so before. These spanners that have been made on the shaping machine may be a bit on the rough side, but the girl who turned them out had been in the centre not more than ten days. So the trainees are helped over the initial hurdles, and they go on to progressively more advanced classes, until they reach the stage where they are producing really fine work. This man on a milling machine is just finishing his course and will be going to his first job next week. He used to be a head waiter in one of the London clubs, and he points out that this was an advantage, anyway, as he is used to standing all day! He didn't feel his feet as many newcomers did during their first week or so. One thing about this sort of job, he said, was that you had something to show for your trouble. You felt you were doing work that was worth while and you could see how it helped the war effort. He hadn't found any great

Above, left: In this nursery, where the young children of women war workers are looked after, a mother says good-bye to her son before she goes off to her war job.

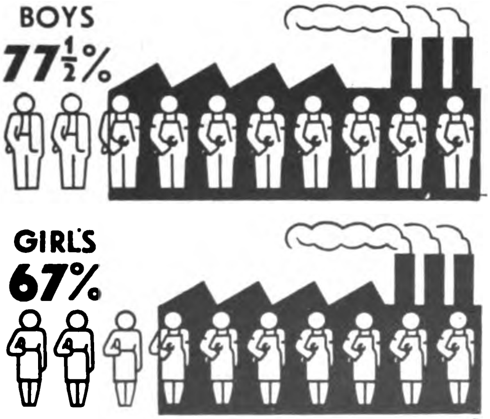
Below, left: This nursery for war workers' children has sleeping quarters so that children can stay here while their mothers go on the night shifts.

Right: The melting shops, the forge and the rolling mills of Britain's great steel works are at work, right round the clock, every day of the week. Here is a giant 4,000-ton hydraulic press forging a rotor shaft of over 45 tons.

difficulty in adapting himself to the factory atmosphere and, on the whole, he had enjoyed it. Apart from it being in your own interest, you felt you had to do your best so as not to let down the instructors.

It is not only machine operators and fitters who are trained here. Inspectors and viewers do not spend very long actually on the factory floor—only long enough to get the " feel " of a workshop—and are quickly started on more or less classroom work, though they are kept constantly in touch with actual production. There is a man here who had a business of his own—a publisher—and is now just ready to go on to an aircraft factory as an inspector. He is nearly fifty and went through the last war. The change over was not too easy, he said, but it was good to feel you were doing something useful. He had certainly known nothing about engineering when he started, but he was reasonably competent now—at least he hoped so—and was looking forward to starting in an actual job. His neighbour had been in China for 17 years and was a gunner officer up to a short time ago. Invalided out, he had come here to train. The adjustment had been rather hard and he was glad to get on to inspection, where he was not so much on his feet. His experience from the artillery had been quite useful as far as mathematics was concerned. Machine operators, inspectors and fitters have been mentioned; that does not, by any means, exhaust the field covered here for there are classes for draughtsmen—nearly all girls with a good education—toolmakers, instrument makers, motor mechanics, welding—a job that men who have lost a leg, or even an arm, can do—and, for that matter, anything else for which trained men and women are urgently needed in the war factories. The trainees who leave the Centre are not fully skilled tradesmen, because experience and varied knowledge cannot be imparted in a few months, but they have received a really sound training, they are capable of turning out good work immediately and, if they have it in them, they can become first-class craftsmen.

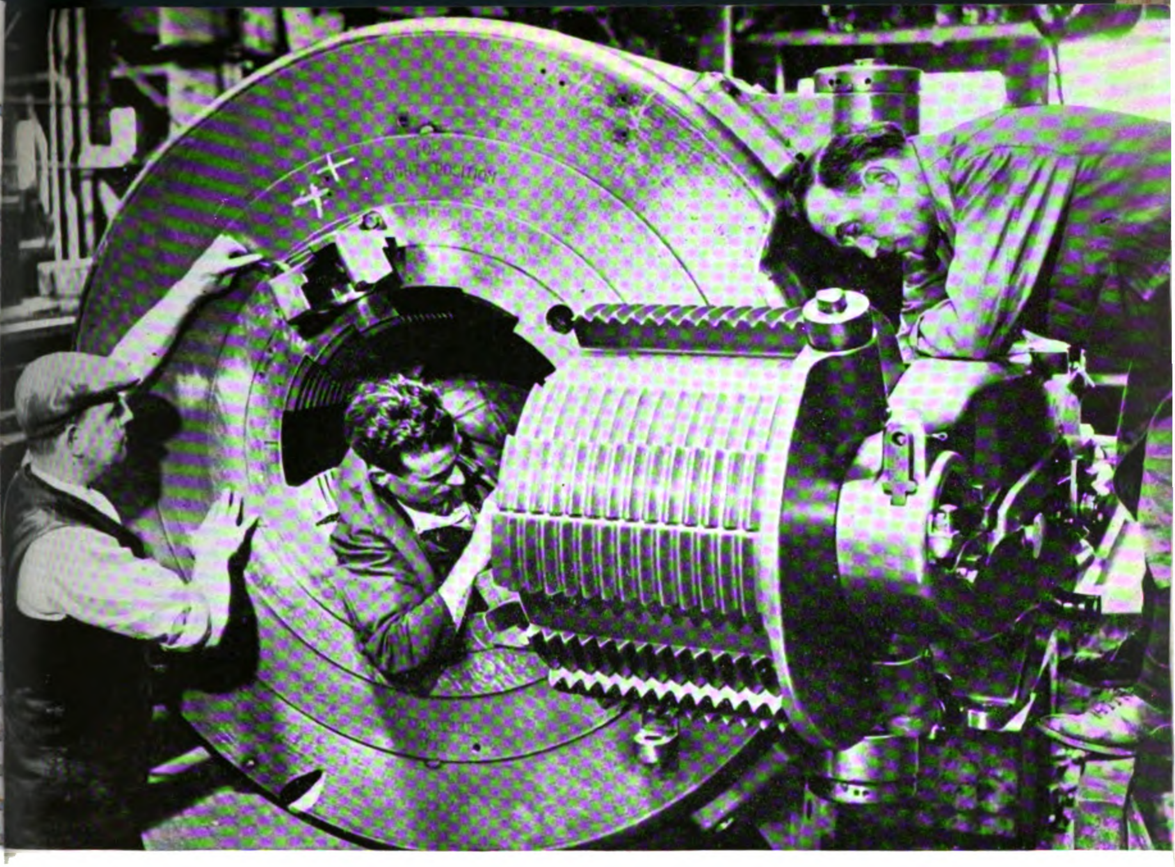
Percentage of British boys and girls between the ages of 15 and 17 doing war work.



ORGANISING THE PART-TIME WORKERS

In the constant search for more output, Britain had already mobilised nearly all available labour some time ago, including, as these stories may have shown, a great force of men and women not usually considered available. The only considerable reservoir left was among those who could, at a pinch, spare some time after doing their normal jobs—many housewives are representative of this class.

There are obvious difficulties in employing people for a few hours each day—duplication of training, extra clerical work, pressure on supervisory staff and so on—and managements had doubted also the efficiency and reliability of such labour. But the experience of those firms that had taken the plunge was favourable, and to-day part-time work is already making a big con-



Here is an engineer crawling through a 16-inch naval gun to make an inspection. The gun weighs 106 tons, is 60 feet in length, and can hurl a 1-ton projectile a distance of 20 miles.

tribution to the national effort and may do even more in the future.

A firm on the fringe of London decided that they ought to experiment with part-time workers to help solve their labour problem and, although the women of the district had no tradition of going out to work after marriage and no industrial background, 160 had been engaged after four weeks' recruitment and there were 300 on the waiting list. The company is now running an entire branch factory on part-timers, except for certain key workers. All types applied for the half-day employment offered. One woman is nearly 60 and has had 10 children; another an elderly widow whose only son is at sea; a third a well-known writer who gave up what would otherwise have been her spare time; and a fourth a woman with two children, whom she can leave in the morning because her husband, coming off the night shift, takes charge of them. That is a fairly representative selection; most of them are actuated at least as much by the wish to help as by the extra money they make.

The Managing Director is very pleased indeed with the results and, turning over the time cards, will point with pride to the large percentage that have no red crosses for absence or lateness. A few do not

Many war workers' children are looked after in the home of an older woman.
This is an important war job for those too old for strenuous work in a factory.

keep very good time, but " you have got to accept the fact that these workers have all got family responsibilities," he says. " I can't grumble if they stay off because little Johnny's got mumps. And I must say most of them are as good and reliable workers as anyone could wish for."

One reason for his satisfaction is the remarkably high output from part-timers. Other employers are finding the same thing. A worker can maintain speed at a monotonous task without flagging at all on a short shift. To start midday with a fresh worker usually means that the average over the whole day is considerably increased. Provided the job is suitable, the secret is good organisation, as it is with the employment of women on full-time work. Arrangements to enable them to do their shopping offer a typical example of what can be done to make things easier.

Two other kinds of part-time work deserve mention. Many of the office staff of a Midlands firm, well known as manufacturers of office equipment and now also producing actual war material, felt they would like to make an even more direct contribution to production. They raised the matter through the machinery of the Employees' Council. The Director of Labour suggested that their wish might be met by offering the office staff an opportunity of assisting in machining and viewing a special type of locking nut made by automatic machines. The shop stewards approved and part-time volunteers were asked for. No pressure was exerted, but two-thirds of those approached wanted to do the work, although they were already doing a 46-hour office week and in most cases Civil Defence duties as well.

Shifts were arranged to fill in all the time the machines would otherwise be idle, and the times allotted to volunteers were: Saturday, 1.15 to 5.15 p.m.; Sunday, 9 a.m. to 1 p.m. and 1.30 p.m. to 5.30 p.m.; Tuesday, Thursday and Friday, 5.45 to 7.15 p.m. The women are engaged on machining and viewing, and the male office staff have been trained in setting the machines, while one is always responsible on each shift for discipline. The scheme has been very successful, with no notable loss of enthusiasm, and although the numbers involved are not large—about 40 a week—it is interesting evidence of the sort of thing that is being done.

Finally there is outworking—that is, taking the work to the workers either in their own homes or at some centre in an area where industrial employment is not otherwise available. One firm has organised a scheme of outworking which within three weeks gave them an output equivalent to 1,800 man-hours a week. That was with only one distributing depot, and it was expected that the weekly time would soon amount to 4,000 man-hours. Here again, suitability of the work and good organisation are the essentials.

There is one other aspect of this vast business of transfer of men and women to war industry that is too often forgotten. The adaptability of those who have to learn new jobs is hardly less than that demanded of management and skilled workers to fit these new recruits into the scheme of things and enable them to do their best. A production manager is faced with new and difficult problems when half the people on a job are women who have never been in a factory before; unless the works manager is open-minded and ready to experiment there will be delay in finding whether jobs formerly the close preserve of men can be done by girls; the foreman and his skilled operatives have a big responsibility in co-operating to get the best out of the personnel available; the attitude of fellow-workers to newcomers is an important factor; the trade unions have had to waive many hard-won privileges and long-established practices in the interests of maximum war output. The results achieved provide the best assurance that all these people have played their part and their success speaks more clearly than anything for the goodwill and determination to win the war that exists in British industry.

Grandmothers—many with sons and grandsons serving in the armed forces—can find war work to do looking after the children of younger friends and relations.

“ *They were soon convinced of its merits when they had handled it.*”

5. QUANTITY AND QUALITY

"*We have good reason to believe that our factories are turning out more munitions in proportion to our population than those of any other nation in the world.*"

THE RT. HON. ANTHONY EDEN, July 1942.

"*The 25-pounder, I may say, is one of the finest guns in Europe, and a perfectly new weapon which has only begun to flow out since the war began.*"

THE RT. HON. WINSTON CHURCHILL, July 1942.

HERE is a brief outline of a British engineering concern's expansion under the influence of war. Ten years ago the total number of employees was about 550. The main output was from the steel foundry, where castings for all sorts of general purposes were produced—parts for automobiles and lorries, locomotives, etc.—and, as there was a large machine shop, many of these castings were supplied in a finished machined state. Other products were steam, gas, oil and petrol engines, air compressors, flangeing machines, coal cutters and work of a general engineering kind.

About the beginning of 1935 this company was approached by the Director of Industrial Planning and became what was known as a "planned" firm. As a result, work was started on certain types of shells and aerial bombs, so that from that time up to the outbreak of war it was preparing for large-scale munitions production. Many of the cast-steel heavy aerial bombs used by the R.A.F. have been developed in this factory. When war started there was a tremendous increase in the calls on the plant's capacity. New shops were erected, existing ones extended, and there was a general reorganisation of resources. The development of many existing lines was necessary to meet war needs, and output of shells and bombs advanced enormously, while such things as gun mountings and tank parts also came into the picture. Research work continues, making valuable contributions to the war effort in the provision, for instance, of certain special carbon steels.

In this period of nine years the number of employees advanced from 550 to 2,000, and turnover has been multiplied by about five. Regarded as a fairly typical instance of the expansion that has taken place in many factories, this brief history shows no evidence of that lack of plan and haphazard improvisation that has sometimes been held characteristic of British industry. It is a record of steady, well-thought-out development from an existing nucleus, maintaining continuity and making full use of the skill, managerial ability and facilities available. It helps to explain one way in which quality has been retained alongside a vast increase in output.

There is no longer room to doubt the quantity of British war production. Not until the middle of 1942 did American output exceed that of Britain, which has only a third of the population. And in spite of the high

level of our present mobilisation still further advances are expected in the future. In 1942, Mr. Oliver Lyttelton has stated, over the whole field of war materials Britain produced about half as much again as in the previous year. But in seeking and attaining quantity, quality has never been forgotten, even at the time of her greatest need—as the Battle of Britain clearly showed—though the conception of what constitutes quality in war has become progressively more functional and more austere.

A Regimental Order of the 155th Lorried Infantry, part of Rommel's army, fell into our hands. It said: "For this reconnaissance, as indeed for every other desert action, only captured British trucks are to be employed, since German trucks stick in the mud too often." The quality that can wring such a tribute from the enemy, the quality that means suitability for the job, is what British industry is giving its products to-day. If the criticism that Britain made machines wastefully well was ever justified in the past, it certainly is not now. The factories making one of Britain's most famous aero engines have always taken nearly as much pride in the thoroughbred appearance and finish of their machines as in their outstanding performance and reliability. It has gone against the grain to leave surfaces rough even where their smoothness would serve no useful purpose, to abandon every kind of non-essential precision and to accept the fact that a machine unsurpassed for quality may look much the same as any other. But they waste no precious man-hours on show nowadays, and the fine workmanship is concentrated on essentials. One may still find perfection of external finish, but only if it produces results—on the outside of a fighter plane, for instance, where it may add miles an hour to the speed. "Utility" clothes in Britain are designed to give efficient service while employing the minimum of labour and material; the whole of British war industry is on a strictly "utility" basis.

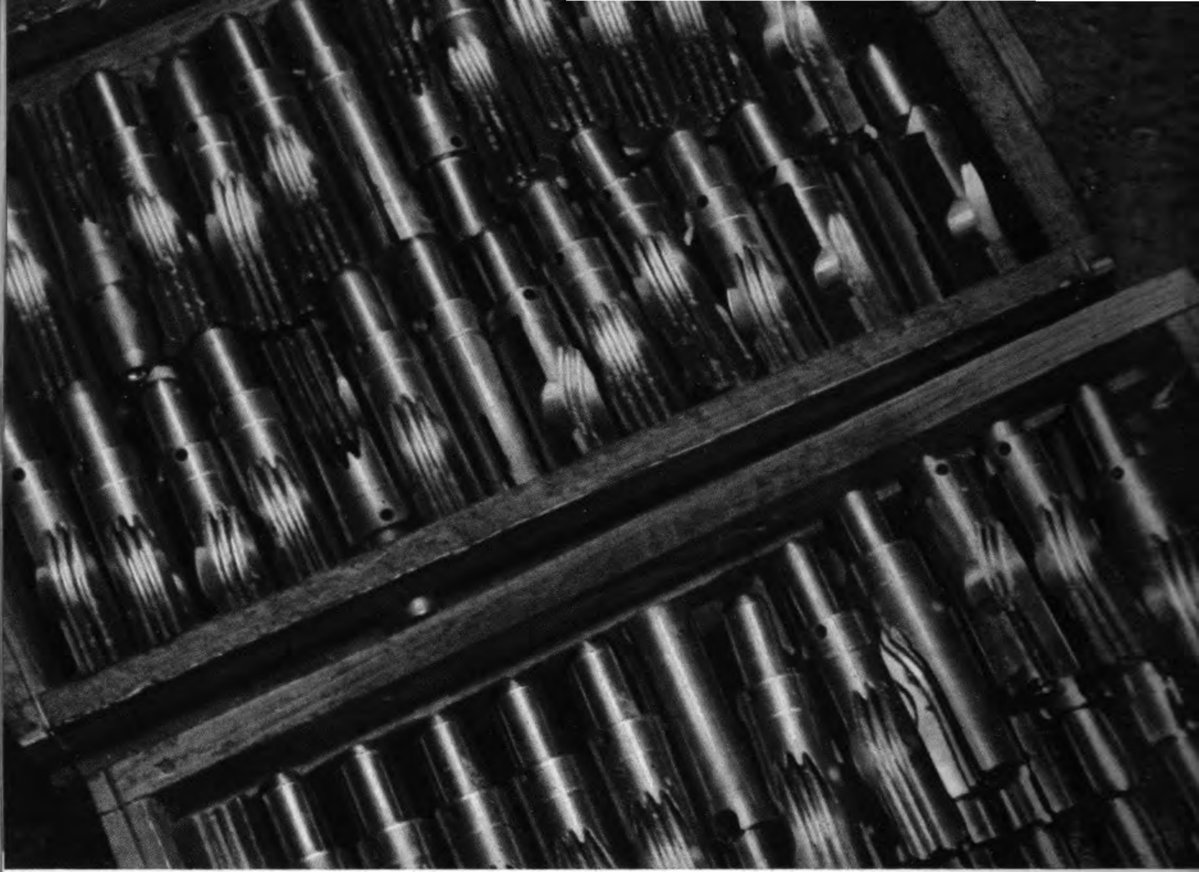
Above, left: An expert tool setter gives one of Britain's women workers advice on operating her milling machine.

Below, left: This young welder came straight from school to her war job. She has three brothers in the British Army.

THE STORY OF THE STEN GUN

The Sten gun is perhaps one of the most spectacular examples of the way in which design has made possible maximum output from available resources, and its "quality" owes nothing at all to finish or complexity. In 1940 experience had shown the value of the sub-machine gun or machine carbine. The Americans had the Thompson, the Germans the Schmeisser and others, but Britain had nothing of the sort, and with the tremendous demand for modern weapons to make good the losses at Dunkirk and equip her rapidly-growing army and Home Guard, it was quite obvious that there would not be anything like enough "Tommy" guns to go round, in spite of the great help given by American manufacturers. Britain badly needed a weapon as good as the Thompson and the Schmeisser, but which could be mass-produced—something unheard of in gun manufacture.

In December, 1940, two men in the Ministry of Supply Armaments Department, assisted by a team of workers, set out to attack the problem. Within a month the gun had been designed and the prototype made. It was demonstrated to the Service Departments, and by the end of January the first order for 100,000 was placed. The gun



Machine-guns produced by a famous British armaments firm receive a final inspection before dispatch to the Forces.

they produced fires almost as fast as the Thompson and as fast as the Schmeisser; it weighs less than either ; it has 59 parts, counting washers and pins, against 90 in the Thompson and 104 in the Schmeisser ; it is at least as accurate as any of the guns in its class. But although its war quality is high, the overriding consideration in its design was that it should be capable of mass-production in well-dispersed plants.

Above, left : Trays of breech blocks for the Sten gun, on the way to be hardened and polished.

Below, left : This operator, milling the breech block of the Sten gun, worked in a cigarette factory in peacetime. Her husband is in the Army.

First, the orthodox butt was discarded and simple stem and shoulder pieces substituted. The gas-operated action is very simple indeed. Welded joints are used wherever possible, and gas-welding technique is employed in the manufacture, to reduce the number of skilled operators and facilitate the employment of women. The barrel, chief bottleneck in small arms production, is turned out by methods that would shock any orthodox engineer. The Sten costs something under £2 against about £40 for the Thompson.

When the Army first saw the gun they were not complimentary. They thought we must be in a bad way if they were to be issued with something that looked rather like a cheap airgun. But those who scoffed at first were soon convinced of its merits when they had handled it. They found that, even if the sights did look as if they had been soldered on as an afterthought, they were nevertheless very accurate; that the gun was very light, could be taken down easily and would go in the pockets of a battle dress; and that it went on firing in the worst conditions.

PLANNING AND PRODUCTION
DESIGN TO SAVE MAN-HOURS

Apart from such an achievement as this, redesign of components of all kinds has produced some remarkable results in reducing the time taken for production. Mr. Lyttelton has quoted some good examples, including that of a machine-gun part which used to take 2½ man-hours and now takes 6 minutes, and the six-pounder gun barrel turned out in 72 man-hours against the 193 formerly needed for the much smaller 2-pounder. Redesign of a percussion fuse part reduced the cost from 15s. to 5s. 5d.; and of a six-pounder breech mechanism from £16 15s. to £3 15s.

The part played by organisation and planning is difficult to analyse, for one can hardly show all the small readjustments that have contributed to the result, but one brief example may be quoted. There is a firm which makes very large quantities of a small electrical component used for many different purposes in aircraft and other war equipment. By a rearrangement of the production line, and particularly by the changing of inspection methods so that the goods were inspected while actually in the line, an increase of 27 per cent. in output was

Production experts discuss the making of the Sten gun—the automatic weapon Britain is turning out in huge quantities.

This automatic machine pours out 300 pins a minute for the Sten gun. It is the simplest, yet most effective, weapon of its type ever designed.

secured with the same gangs working the same hours under identical conditions.

Where production time is saved by a new machine, there is not usually much to be said except that a more efficient way has been found of doing the job. For instance, the turning of samples of steel for testing formerly may have been the work of a man using a lathe and producing perhaps half-a-dozen an hour; by introducing an automatic, single-purpose machine a girl may possibly turn out 60 an hour. The invention of new methods and the application of mechanism to former hand work may provide a rather more interesting example. At an aircraft factory in the North a process was developed some time ago for press-bending small pipes, work generally done by hand by skilled copper-smiths. The older method was satisfactory as long as only a few machines were being built at a time, but in a modern aircraft factory where large numbers of pipes are involved and where accurate and standardised contouring is required it was too slow. This company tackled the job and perfected a method of bending the pipes mechanically without skilled labour. It produced accurate repetition to the interchangeability standard, and greatly reduced the time compared with hand methods. Complicated contours with bends in several planes could be turned out as accurately and almost as readily as simple bends in one plane. The cost of the forming tools is relatively small as wood is used almost exclusively.

ADAPTING THE FACTORY TO THE WAR JOB

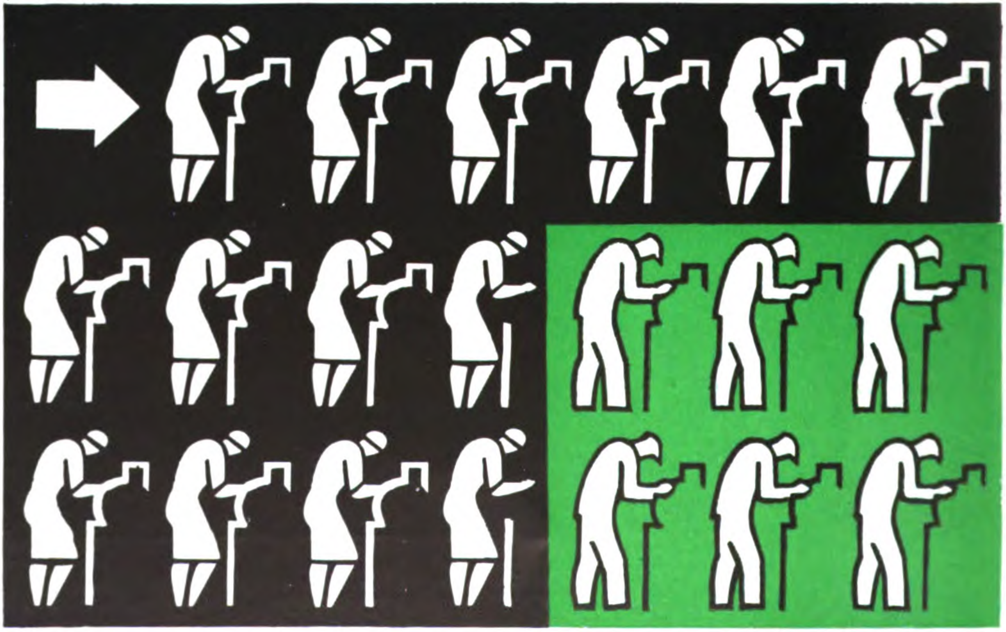
The successful adaptation of non-essential plant is one of the big factors in war production, and while engineering factories lend

Fitting and testing Sten guns, part by part. Although it is so simple in design it is made with traditional British craftsmanship.

Many of the smaller workshops of Britain make parts for the Sten gun. Here is a store in a Royal Ordnance Factory to which these parts are sent.

themselves obviously enough to the changeover, it is often possible also to secure highly efficient and valuable production from the most unlikely works, provided that they find—or are found—the right work. In 1876 a factory was opened for making fretwork panels for the fronts of pianos; that does not sound a very promising plant for war use but, in fact, managed by the two sons of the founder and their two sons, it is now making detonator trays, detonator safety tweezers, blocks for shell fuses and filling frames for Royal Ordnance Factories. This is much more than a makeshift. The workmen are highly skilled and their training is admirably suited to the job. They are producing very accurate work, in some cases to a limit of one two-thousandths of an inch.

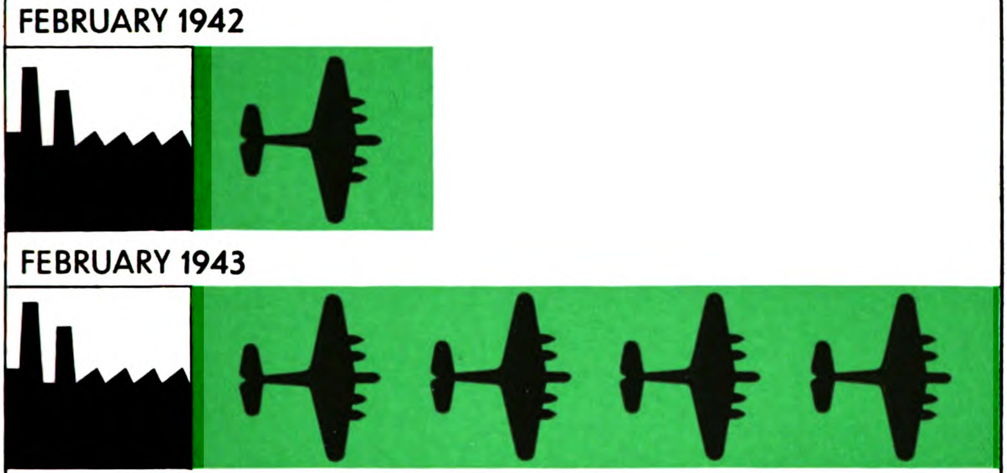
Apart from those types of production which have necessitated the creation of huge new units such as the Royal Ordnance Factories, the initiative and knowledge of individual companies is of the utmost importance. A story was told not long ago which shows how much can be done by a management that is keen and takes a real pride in achievement. There is a factory which at the beginning of the war did a great conversion job, turning over the whole of the plant to war work. Right from the start it had been the company's policy not to embarrass the Government by asking for new plant or new supplies of skilled labour. They invented



Women form **70%** of the workers in some British factories making big guns

Increasing output of Britain's heavy bombers

(*latest official statement*)



"In February we produced more than 4 times the number of heavy bombers that we did a year ago"

BRITISH MINISTER OF PRODUCTION April 1943

new ways of converting their automatic machines to new tasks and they trained the personnel they needed.

Early in 1942 they were asked by the Ministry of Supply to get extra factory space in a non-industrial area for the production in quantity of a certain component. Production had to start in six weeks and to approach peak in another six weeks. They accomplished the task in the time without asking for any priority supplies of bricks or building materials or anything else.

A building that used to be a prison was taken over, completely cleared and converted into a three-storey factory. The cells were turned into stores, works canteen, kitchens, etc., and electric hoists and loading ways were installed. Meanwhile, labour had been recruited and was being trained by skilled workers from the firm's original plant, and their own specially-designed machines were installed. By the time the first six weeks were up production had actually begun, and the long rows of cell doors with their heavy bolts and bars were about the only reminder that the place had once been a prison.

"The atmosphere is friendly and informal. The members know each other well, for most of them have been with the company for many years."

6. GOODWILL in the WORKSHOPS

> *"Germany has needed the Gestapo and the most ruthless system of regimentation to mobilise her forces. Through our free institutions, by goodwill and by agreement, we have accomplished a mobilisation and control of our manpower and womanpower most certainly not less complete."*
>
> MR. M. S. MCCORQUODALE, Parliamentary Secretary,
> Ministry of Labour and National Service, October 1942.

SOME time ago, in the days when it was still possible to believe that a factory might be producing luxury goods, a certain works was making a small plastics part. As far as the operatives could judge it might have been used for almost any purpose. Things were not going very smoothly in the factory, and the management found that, although wages, hours and conditions were exceptionally good, they were losing a number of workers week by week. They set about finding a reason, and discovered that their people did not want to stay on the job because they thought it was making no contribution to the war effort. In point of fact the article was a small component used in certain equipment for aircraft, and no time was lost in explaining this to everyone concerned. The effect was immediate. There was a different atmosphere about the place, and a new enthusiasm as soon as the workers knew they were doing something useful.

That is typical of the sense among all sorts of people that they have a real part in the war. There are black sheep, as in every fold, but the great majority have done as much as they could, not simply what was demanded. Although large measures of control have been introduced to secure equity and adequate control, Britain's industrial organisation in fact has depended fundamentally on willing, intelligent co-operation from every man and woman in factory and office. There have been many examples to prove that, once British workpeople know how their effort really helps, they will produce the best possible results. There was the case of a works making ropes and cords. Although the operatives probably knew in general terms that their output was for war purposes, it became evident that they did not appreciate its direct and immediate functions. So posters were prepared showing, for instance, that some of the cords they made were for parachutes that saved the lives of our pilots, and how commandos used their ropes for scaling cliffs. On a Friday night these posters were put up in the works, which at that time were engaged on a particularly urgent Service contract. Next day the workers volunteered to put in full Saturday and Sunday shifts to finish the job on time.

In another instance it had been difficult to convince the men in a Glamorgan iron ore mine of the special urgency of securing maximum output. The ore was actually used to supply steel for tanks. Results were quite good, but it seemed that a little more drive and enthusiasm might make a considerable difference. A big chart was therefore prepared, illustrating what each day's output was in terms of tanks. A good many of the miners stopped to have a look at the chart as it was being erected; when they finished the shift they noticed that it had been altered to show the number of tanks for which their work would provide the raw material. Their interest was caught, and more and more of them examined the chart each day as they passed to see how they were getting on. There was a 14 per cent. increase in output at the end of the first week, with no other changes in conditions that could account for the improvement.

Direct contact with the men who use the weapons is another way in which those who produce them are helped to understand exactly what their work means; as one works reported after the visit of Service speakers—they " bring a breath of air to an umbombed area like this." A typical example of what is being done is the visit to three Lancashire factories of an R.A.S.C. sergeant just back from Murmansk. He had seen the arrival of material from these actual factories and could tell the workers from his own knowledge how the weapons were being used by the Russians. Increases in production of 4, 13, and 17 per cent. respectively were reported from these units following his visit.

Possibly the most significant development of all, however, is the increasing part taken

British factory workers, and their families, are taken to see the fighting men using the weapons they help to make.

by the workers in helping to secure maximum efficiency in organisation and technique.

THE WORKERS' PRODUCTION COMMITTEES

To-day suggestions come constantly not only from management and directors but from those engaged on the actual operations, and this has been encouraged and organised by the establishment in a large number of factories, including all Royal Ordnance Factories, of Joint Production Consultative and Advisory Committees on which both management and workers are represented. It is the business of these committees to see that no idea for improving output shall be neglected, and that there shall be regular contact between those responsible for organisation and those who are on the job. It must be emphasised that such machinery is, in fact, useless unless goodwill and the desire to co-operate exist. There have been cases in British factories where the committees set up have been a failure, but it is a tribute to the excellence of industrial relations generally that most of them are doing valuable work and making a big contribution to the war effort.

To describe an actual meeting may show better than anything else the nature of an outstanding development in worker management co-operation. The committee in question, at a large engineering works, was set up in the middle of 1942 after agreement had been reached between the Engineering Employers' Federation and the Trade Unions in the industry. It is meeting in a room in the works canteen. One of the directors is in the chair; the management is represented by two other members of the committee, one of whom acts as joint secretary. The other secretary is the representative of the machine shop and the fitters and has been nominated for the post by the workers on the committee, who number seven and who are elected by the employees in the various groups—foundry, pattern-makers, general workers, etc. All meet together as one body, not as opposing or negotiating sides, all have equal standing and all are seeking to improve production in the works and thereby help the war effort. There are also present two foremen and one member of the executive who are specially interested in items coming up for discussion. The atmosphere is friendly and informal. The members know each other well, for most of them have been with the company for many years, and, as their chairman says, they pull together as a team. Various matters arising out of the minutes are taken first. The Committee had considered at its last meeting whether it should

Posters in British factories, which appeal to the generous spirit and willingness of the British worker, help to keep enthusiasm high.

The canteen kitchens of British factories are modern, clean and efficient. Thousands of meals are prepared daily in the kitchens shown here.

deal with questions of absenteeism; now, after due reflection, it decides unanimously to do so. Next, there are reports on a number of suggestions put forward by one of the worker members for improved organisation in the shop he represents. Each is dealt with separately, and most have been adopted. For instance, a new jib crane is being installed so as to avoid waiting for the overhead crane when it is unloading lorries; gas burning gear has been provided outside the shop to save handling large sections; and extra space has been made available in the machinery store. The other points arising from the minutes are the subject of equally detailed treatment, and action is reported as a result of earlier discussions on week-end work, the employment of women, the improvement of factory lighting and the handling of repeat orders for small quantities.

Then the Committee turns to the rest of its agenda. There are 22 separate items. It is impossible to describe them all here, but a few instances indicate the type of work the Committee is doing. There is a discussion on improving the heating of some of the shops, for example, and for economising fuel. The Chairman explains the plans made for the future, and states what action is being taken immediately to meet specific difficulties. It is agreed that a saving might be effected by special arrangements for heating the shelter used by the firewatchers and the A.R.P. officer is to be asked to look further into this. The workers' joint

The food served in factory canteens is wholesome and plentiful.
The canteens are comfortable, airy and kept spotlessly clean.

secretary reports that a suggestion was put forward for some modifications in one of the machines manufactured by the company, and the matter had been taken up with the Designs Department. As a result, changes had been made so that one particular machining operation had been eliminated altogether.

Another question raised is the desirability of checking all tools when returned to store to ensure that they are in good working order for re-issue. In certain of the shops a tool inspector is employed, so the matter does not arise, but in the big machine shop some change seems desirable. The foreman responsible explains the reason for the present organisation, but there is general agreement that in wartime conditions the system is not working altogether satisfactorily and arrangements are made for a station in the tool store where tools will be placed for examination and cleared up two or three times a day. A similar point comes up over the issue of drawings and special tools, and it is left to a member of the committee to investigate with the foreman, so that a decision may be taken.

The provision of a first aid room for dressing minor injuries is suggested by a member, in order to save time now spent attending the Works' Surgery. The Chairman says he has referred the suggestion to the doctor, who thinks it would be inadvisable to depart from present practice as the absence of serious trouble from septic wounds is, in his opinion, largely due to the existing arrangement. The Chairman quotes the monthly accident statistics to show that very little time is, in fact, lost from this cause, and the member who made the suggestion agrees that in the light of this explanation no further action is necessary.

There are many other points affecting the efficient use of machines, or the desirability of acquiring further equipment, the layout of plant and shops, possible changes in works practice and economy of electric power; the few examples that have been quoted may at least show how the workers' representatives try to make the fullest possible use of the intimate knowledge of the man on the job and how the management approach their suggestions with an appreciation of their value and a desire to adopt them wherever possible. To illustrate a little further how this co-operation helps efficiency, one item from the minutes may be given in full with the relevant report at the next meeting. It is typical—not spectacular. "An alteration in the position of two jib cranes," the minutes state, "in the Welding and Riveting Section was recommended, one to be placed over the burning machine and the other over the drilling machine where they can be used to better advantage." The next set of minutes reports: "A jib crane for the Drilling Section has been installed. The suggestion for transferring a jib crane from the Riveting Section and refitting it over the burning machine is not a practicable proposition, as the Riveting Section requires the use of

Many factory workers live in specially-built hostels. Here is the library of one of them. The workers, to remain efficient, must have facilities for recreation and reading.

the existing crane; steps have, however, been taken to find some other suitable crane for this burning machine. Arrangements will also be made to move a jib crane from a point in the Welders' Section to a more useful position. The Millwrights' Department have the matter in hand and will deal with both jobs."

The desire to increase production by the "swapping" of ideas has also led to the exchange of visits between the Joint Production Consultative and Advisory Committees of different works in somewhat similar lines of business. The results have provided a good deal of mutual advantage. The visitors often prepare a report of their impressions which may benefit their own practice and that of the works they inspect by drawing attention to both efficiency and inefficiency in plant, technique and organisation. One such report runs to over four foolscap sheets, although it is in summary form, and deals with nearly 30 different observations. There are many points on which the visitors consider their own firm could profit by what they have seen, and the things they admire include certain machines, ingenious adaptation and good organisation, economic use of precision instruments and tools, the canteen system and the method of issuing tools. But they draw attention to what seems to them the wasteful employment of a lathe which should be on better work, insufficient use of women for some types of job, and the lay-out of one of the shops. So, week after week, the tightening-up continues.

This pleasant breakfast-room scene was taken in a hostel for girls working in a factory. Pleasant living conditions maintain the health and efficiency of the workers.

in conclusion . . .

Any attempt to show by means of examples something of the effort and organisation behind Britain's industrial achievement must of necessity omit far more than it can include. No stories have been taken from, for instance, shipbuilding for the arbitrary reason that it seemed impossible to enter such a field without spending there more time than could be spared. There is little about those who make trivial, unexciting, essential things like buttons for battledress, or bootlaces, and no adequate illustration of the great mass of detailed, routine office work which is the lubricant of modern production. But if some idea has been given of the multitude of jobs well done, of the planning that is the framework for the whole, of the spirit animating men and women of all sorts in British industry to-day, then these pages may at least help to explain how and why Britain's output of war materials has reached such heights.

So in hundreds of industries all over the country, in the daily life of thousands of factories and in millions of individual acts of perseverance, discipline and good humour under strain, the whole working population of Great Britain—managers and workpeople, men and women—takes its stand at the side of the fighting Services.

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war job

WHAT BRITAIN HAS DONE

1939 · 1945

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What Britain has done

FOREWORD

THE War Effort of Britain (the United Kingdom of Great Britain and Northern Ireland) is one important contribution to the common war effort of the United Nations. It is under this aspect that the British war effort is constantly viewed and operated. Such is the perspective of the outstanding facts and figures of Britain at war which are here presented. These facts are still not exhaustive, although much illuminating information has been made available in the White Paper (Cmd. 6564) presented by the Prime Minister to Parliament by Command of His Majesty on 28th November, 1944. Until the whole story can be told, the following selection is issued in the belief that it would be a grave disservice not only to Britain but also to her Allies in the common cause if an excessive reticence were to prevent a general understanding of what Britain has done in the Second World War.

Reference Division,
Ministry of Information.

9th May, 1945.

R.653.

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What Britain has done

SEPTEMBER 1939—MAY 1945

A Selection of Outstanding Facts and Figures

1. THE ACHIEVEMENT OF BRITAIN AT WAR

> "*We must not underrate the gravity of the task which lies before us or the temerity of the ordeal, to which we shall not be found unequal. We must expect many disappointments and many unpleasant surprises. . . . If these great trials were to come upon our island, there is a generation of Britons here now ready to prove itself not unworthy of the days of yore and not unworthy of those great men, the fathers of our land, who laid the foundations of our laws and shaped the greatness of our country. . . .*"
>
> RT. HON. WINSTON CHURCHILL, *3rd September*, 1939.

Perspective

The policy of Britain in the world has for generations been very largely directed in accordance with two constant traditions. The first of these has been the maintenance of peaceful progress as far as possible in all quarters of the globe. Between the two world wars Britain, as is notorious, made sincere, prolonged and unavailing efforts to maintain peace in the face of fascist provocation. But the second constant tradition of British policy is uttermost resistance to attempts by any despotic aggressor to conquer and hold down the continent of Europe. Britain has accordingly fought necessary and successful wars against the dominations of Louis XIV, Napoleon and Wilhelm II. In 1939 she began to fight the domination of Hitler. In this war, as in the previous one, Britain became the focus of a grand alliance against aggression. Nor is her determination to resist aggression limited to Europe. The destruction of the Japanese militarism and the liberation of the peoples and territories which have fallen victims to its aggressive appetite are likewise in the forefront of British aims and policy.

Performance

Britain was the first nation in the world to go to war with Hitler's Germany without first being attacked herself.

Britain has been fighting Germany longer than any other nation except Poland.

Britain in 1940 saved the world from German domination by winning the Battle of Britain all but single-handed.

Britain's testing time in 1940-1 inspired her citizens to conduct which won the respect and admiration of the world.

Britain's total war-effort per head of population is greater than that of any other belligerent.

Britain's strategy from 1940 onwards led up to total victory in Africa, to the redemption of the first whole continent from the enemy, and by preserving and developing Britain as the offensive base prepared the way for the invasion and liberation of the European continent.

Britain's campaigns in East and North Africa, culminating in the triumph in Tunisia, were among the most extensive and the most successful in all history.

Britain's sea-power in the Mediterranean was a decisive factor in all the warfare against Italy, which achieved her unconditional surrender.

Britain's forces by their successful campaign in Burma have maintained for two years the largest land front against Japan.

Britain's sea-power was the starting point and prime factor for the successful prosecution of the all-important Battle of the Atlantic, upon which the whole development of Anglo-American strategy depends. Britain's sea-power made it possible to maintain the Arctic Convoys which have been carrying Aid to Russia since August, 1941. Without sea-power the "glorious story" of the landings in North Africa, Sicily, Italy and France would not have been possible. The Battle of Normandy—"the greatest and most decisive single battle of the entire war"—was followed by the offensives which carried the Allies to the frontiers of Germany, over the Rhine and into the heart of the Reich.

Britain has in this war raised the renown of her Royal Air Force to match that of her world-famous Royal Navy. The work of these two services on D-Day, co-ordinated with that of the Armies they transported and protected, constitutes the greatest combined operation in history.

Britain has radically transformed her national existence by the extent of her mobilisation for war.

Britain has been fanatical in stripping herself for war. No burden has been shirked, no sacrifice refused, no effort spared, no treasure stinted that might ensure or hasten ultimate victory, or tip the balance in a grim and bitterly contested struggle for freedom and very existence. The cost has been heavy, but has not been allowed to impede the British effort.

2. THE ACHIEVEMENT OF MANPOWER MOBILISATION

> "*We shall not hesitate to take every step, even the most drastic, to call forth from our people the last ounce and the last inch of effort of which they are capable. The interests of property, the hours of labour, are nothing compared with the struggle for life and honour, for right and freedom, to which we have vowed ourselves.*"
>
> RT. HON. WINSTON CHURCHILL, 19*th May*, 1940.

Perspective

Great Britain's population of effective working age (males aged 14-64 and females aged 14-59) is relatively limited. At 30th June, 1944, it totalled 31,930,000. Of this figure 22 million had been mobilised by the same date.

The remaining 10 million consisted mainly of housewives with domestic responsibilities for war workers, children, billetees, evacuees and invalids, and of students and school children over 14, and invalids (including war invalids).

British manpower mobilisation has accordingly been of the most stringent order. Of all the factors in war production manpower is particularly vital for Britain. It is also the most stable, and Britain has had to make the maximum effective use of her resources of manpower and good organisation in order to make good destruction of plant, factories, ports, railways, etc., by enemy action, and offset difficulties in the import of raw materials, shortages, etc.

Over and above this, millions of British men and women have been taken out of production for the armed and auxiliary services and for whole-time civil defence. Yet the total volume of production has been increased.

Performance

The magnitude of the task which the total mobilisation of available manpower involved is shown by the fact that since the beginning of the war those responsible have had to deal with more than 30,000,000 registrations for national service of one kind or another.

Of the total figure of 15,910,000 males aged 14-64, 14,896,000 (or 93·6 per cent), had been mobilised in June, 1944.

Of these, 4½ million were in the services, 225,000 in whole-time Civil Defence, 3,210,000 in the munitions industries, 4,059,000 in other essential work and 2,900,000 in other full-time employment.

The total of 4½ million men serving in the Armed Forces of the United Kingdom, compared with less than half a million at the beginning of the war, had been reached in spite of the casualties of five years of war. Including the number killed, missing, taken prisoner, or released on medical and other grounds, the total number of men who have served or are serving in the Armed Forces of the United Kingdom during this war is over 5½ million.

These men have been drawn mainly from the younger age groups. 57 per cent of all men between the ages of 18 and 40 have served or are still serving in the Armed Forces. The other men in these age groups have been retained in industry because of special skill, particularly in making munitions, or because they were unfit for service in the Armed Forces.

Those neither in the Services nor in whole-time Civil Defence, were giving additional service in their spare time—1¾ million in the Home Guard, 1¼ million in part-time Civil Defence, and most of the remainder were performing 48 hours a month Fire Guard duties. These additional duties were obligatory for men who did less than 60 and women who did less than 55 hours a week in their employment.

Of the total of 16,020,000 women aged 14-59, 7,120,000 had been mobilised in June, 1944.

Of these 467,000 were in the Auxiliary Services, 56,000 in whole-time Civil Defence, 1,851,000 in the munitions industries, 1,644,000 in other essential work and 3,102,000 in other full-time employment. The remainder were mainly housewives.

Some 900,000 were doing part-time work in industry (but have been included in the figures on the basis of two being equivalent to one whole-time worker) and 350,000 were doing part-time Civil Defence work.

Many others were doing war work in a variety of ways as members of salvage parties, collectors for Savings Groups, making and distributing hospital supplies, comforts for the Forces, and the Merchant Navy, etc.

Great Britain in 1941 was the first country to conscript women for the uniformed Auxiliary Services.

Of women in the 18-40 age groups, 90 per cent of the single women are working and over 80 per cent of the married women and widows without children.

Of women in the 18-50 age groups, 750,000 married women and widows with children and 2,000,000 without children are in paid employment.

Of single women in the 55-60 age group, 100,000 are in paid employment, excluding those in private domestic service.

At least 1,000,000 women of all ages are rendering voluntary service.

Women have played a magnificent part in freeing men for the forces or heavy industry.

In 1943, 40 per cent of the employees in the aircraft industry were women as compared with 12 per cent in 1940. In the engineering and allied industries the corresponding figures are 35 per cent in 1943 and 16 per cent in 1940.

About half of all the workers in the chemical and explosives industry are women.

In the munitions industries, including shipbuilding and heavy engineering, one worker in every three is a woman.

In agriculture and horticulture the introduction of 117,000 women has freed nearly 100,000 men ; while 160,000 women have replaced 184,000 men in the various transport services.

Between June, 1939, and June, 1944, there was a net addition of 1,345,000 women in the munitions industries, 792,000 women in the basic industries and 523,000 women in the Auxiliary Services and whole-time Civil Defence.

Nearly three in every four British boys and girls between the ages of 14 and 17 are doing work in vital industry.

In order to achieve this mobilisation of manpower the British have had to make many sacrifices and changes in the home life so dear to them. 22½ million removals of civilians alone have been recorded.

8,528,000 men and women workers are covered by Essential Work Orders. These Orders restrain workers in certain scheduled essential industries from leaving their employment and employers from dismissing them, except for serious misconduct, without the permission of a National Service Officer.

The needs of the Services have been met partly by voluntary recruitment, but mainly by compulsory enlistment of men registered under the National Service Acts.

The compulsory enlistment of women in the Auxiliary Services was introduced in December, 1941.

Compulsory registration for employment was also introduced in 1941.

Casualties have made severe inroads into the manpower available for the prosecution of the war. The total casualties (Armed Forces, Merchant Seamen and Civilians) sustained by the United Kingdom up to the beginning of May, 1945, amounted to close on one million.

Of this total 746,109 were suffered by the Armed Forces (228,383 killed, 59,476 missing, 274,148 wounded and 184,102 prisoners of war). In spite of these losses the total strength of the Armed Forces increased each year since 1939.

During the same period 30,589 Merchant Seamen serving in British ships were killed by enemy action at sea and a further 12,993 were missing, wounded or interned by the enemy.

By the beginning of May, 1945, the total of civilian casualties was 146,760. Of these 60,585 had been killed or died of injuries (including 25,392 women and 7,623 children) and 86,175 had been injured and detained in hospital. More than half (80,307) of the total civilian casualties occurred in the London region.

3. THE ACHIEVEMENT OF THE BRITISH ARMY

Perspective

British strategy was traditionally based upon a large navy and a relatively small army, which would form the framework for a systematic expansion to augment the great continental armies of her allies, in recent times France. But the fall of France at once threw the whole brunt of the war upon Britain at a time when the bulk of the Army's equipment had been lost at Dunkirk.

Yet, even while Britain herself was imminently menaced by German invasion in 1940, the British Government took the bold and successful decision to send out important reinforcements to the Army of the Nile under General Wavell in accordance with long-term British strategy in the Mediterranean. The British Army was outnumbered by the enemy in every one of its campaigns in the first three years of war.

Performance

(*a*) Preliminary

> "*We shall not be content with a defensive war. . . . We must put our defences in this island into such a high state of organisation that the fewest possible numbers will be required to give effective security and that the largest possible potential of offensive effort may be realised.*"
>
> RT. HON. WINSTON CHURCHILL, *4th June*, 1940.

> "*. . . . After more than five years of war we still maintain almost exactly the same number of divisions taking both theatres together (North-West Europe and Italy) in full action against the enemy as the United States have, by all the shipping resources which can be employed, yet been able to send to Europe. Considering that the population of the Empire of British race is only* 70,000,000 *and that we have sustained very heavy losses in the early years of the war, it certainly is a remarkable effort. . . .*"
>
> RT. HON. WINSTON CHURCHILL, *28th September*, 1944.

The British Army not only fought the enemy on the battlefields of Europe, Africa and Asia, but also performed the key task of containing the enemy in strength by action in the British Isles, Iceland, Gibraltar, Malta, Cyprus, Palestine, Iraq, Syria, Persia, Madagascar, India.

1,600,000 British men joined the Home Guard as volunteers in less than two months from its formation in May, 1940. Meantime the re-formed British Army was pacing into battle-drill, the arduous and novel method of British military training which has produced such conspicuously successful results.

British Commando raids gained most valuable experience for the subsequent great amphibious attacks.

British resistance in Greece in the spring of 1941 seriously upset the German timetable and gained time which was of the first importance to our Russian allies.

The successful campaigns in Syria, Iraq and Persia in 1941 consolidated the very important Middle Eastern area against Axis designs and secured the supply lines by way of the Persian Gulf to Russia.

(*b*) AFRICA

> "*One continent at least has been cleansed and purged for ever from Fascist or Nazi tyranny.*"
>
> RT. HON. WINSTON CHURCHILL, *19th May*, 1943.

British armies conquered the whole extent of the great Italian Empire in Africa with an area of 1,346,000 square miles and a population of approximately 12,988,000. (These armies of which the majority were composed of men from the United Kingdom also included Australian, New Zealand, South African and Indian Divisions).

975,000 men was the total of Axis casualties in Africa. More than 248,600 of these were Germans, and some 226,000 were natives serving in East Africa. The remainder were Italians.

220,000 killed, wounded and missing were the total casualties suffered by the forces of the British Empire in the African and Middle Eastern theatres of war.

2,550 tanks, 6,200 guns and 70,000 lorries were captured or destroyed by British and Allied troops in all the African campaigns.

In the East African campaign the forces under Generals Cunningham and Platt in a few months conquered Abyssinia—a powerfully defended country more than half as large again as Germany. The first country to go under to Axis aggression was the first to be freed.

British troops swiftly overran Italian East Africa, thus greatly facilitating all later African successes, despite the fact that at the start of the 1940 campaign the British forces in the Sudan sector were outnumbered by almost ten to one.

In the East African campaign, in 17 days (1st-17th March, 1941) the columns under the command of General Cunningham drove 744 miles from Mogadishu to Jijiga : an average of nearly 44 miles a day. This at the time was the fastest military pursuit in history. It was later approached by the onrush of the Eighth Army in 1942-3, and was surpassed by that of the Guards Armoured Division through France and Belgium in 1944.

General Cunningham's troops in the East African campaign advanced in all 1,725 miles to Addis Ababa in 53 days—a staggering achievement.

250,000 men—the whole of an enemy army—were put out of action in the first North African campaign. Less than 2,000 casualties were suffered by the army under Generals Wavell and Maitland Wilson.

In the final North African campaign the British Eighth Army under Generals Alexander and Montgomery routed the Axis forces in the victorious Battle of Egypt fought at El Alamein, October-November, 1942, which for the British Empire marked the turning point of the war, and was the first major defeat of the German armies in the field.

Over 86,000 casualties were inflicted upon the Germans and Italians when the British Eighth Army drove the enemy out of Egypt and Libya. The enemy further lost about 500 tanks and 1,000 guns of all types.

The British Eighth Army drove the German Afrika Korps 1,800 miles across North Africa.

The British First Army with its paratroops headed the Allied drive into Tunisia in November, 1942.

The enemy armies in Tunisia were routed and completely destroyed, and their commander-in-chief taken prisoner, within less than one week from the opening of the final Allied offensive on 5th May, 1943.

At least 248,000 enemy prisoners and 26 generals were captured in Tunisia between 5th May and 13th May, 1943. This constitutes one of the greatest defeats ever inflicted upon the German Army.

To achieve these victories in Africa before the reopening of the Mediterranean, sea voyages of over 12,000 miles were involved for the troops and supply ships. What this means can be judged by the fact that in order to transport the stores of *one* ordinary infantry division overseas 7 ships of 10,000 tons each are required carrying upwards of 200,000 packing cases.

The victorious pursuit by the Eighth Army across North Africa was rendered possible by a triumph of British military administration. 120,000 lorries helped to carry the 2,400 tons of all stores which were supplied every day to the constantly advancing British troops. 2,000 new tyres were issued daily for these lorries.

76 per cent of the Eighth Army and 90 per cent of the First Army in Tunisia were troops of the United Kingdom.

(*c*) ITALY

> "*We nave here in Italy one of the finest armies in the world. The combination of the Fifth Army and the British Eighth Army binds two veteran armies in a bond of brotherhood and comradeship of arms. No operation could have been more fruitful in this theatre than the work you have done in drawing away perhaps two dozen or more enemy divisions down into Italy where they have been torn to pieces.*"
>
> RT. HON. WINSTON CHURCHILL, 21*st August*, 1944.

The victories of the British arms were very largely responsible for the unconditional surrender of the kingdom of Italy in September, 1943.

British Airborne troops headed the invasion of Sicily on 9th July, 1943, less than two months after the conquest of Tunisia.

The British Eighth Army (including a Canadian Division), together with the American Seventh Army, conquered the large island of Sicily in 39 days (9th July-17th August, 1943).

About 167,000 of the enemy were killed, wounded or taken prisoner in the Sicilian campaign. This included 24,000 Germans killed and 128,000 Italians captured.

500 enemy guns, 260 tanks and 1,100 grounded aircraft were further captured by the Anglo-American forces in Sicily. The enemy lost 1,691 aircraft in all between 10th July and 17th August, 1943.

The British Eighth Army led the assault upon the Fortress of Europe when they landed in Italy on 3rd September, 1943.

The landings of the Anglo-American Fifth Army at Salerno and later at Anzio were, at the time, considered to be the most daring amphibious operations ever launched upon a similar scale in war.

On 11th May, 1944, General Alexander, Commander-in-Chief of all Allied Forces in Italy, launched the attack which broke through fortified German defence lines, and effected a junction of the main armies with the Anzio bridgehead forces. These brilliant moves and offensives which resulted in the liberation of Rome by forcing its abandonment by the enemy without any destructive fighting within the city itself, were part of General Alexander's daring and original strategy.

By the middle of August, 1944, the port of Ancona had been captured and the great city of Florence had been liberated by the British Eighth Army. The 5th Army held the valuable port of Leghorn.

These operations during the summer and autumn of 1944 forced the Germans to employ up to 30 divisions. These divisions had lost a total of 194,000 in casualties—equivalent to the total destruction of 15 full-strength divisions.

In November, 1944, General Alexander was promoted to the rank of Field-Marshal (with effect from 4th June, the date of the liberation of Rome) in recognition of the brilliant strategy which had marked his conduct of the campaign—to end on 2nd May, 1945, with the surrender of 1,000,000 enemy troops.

The largest mass of all troops—in fact approximately half the number of divisions on the Italian front has come from the United Kingdom.

(*d*) THE BALKANS

Early in 1943 a British Officer entered Yugoslavia by parachute, and was for 8 months attached to Marshal Tito's headquarters. His mission was to advise the British Government on measures of help for Marshal Tito's partisans. In the autumn of 1943 a larger mission was established.

In the summer of 1944 units of British Land Forces Adriatic supported the partisans in operations against the Germans.

In October, 1944, units of Land Forces Adriatic cleared the enemy from the islands of Naxos, Lemnos, Karpathos, Santorin, Chios, Mytilene and Samos.

By November, 1944, as a result of the threat of the Red Army together with the successful operations of British Land Forces, Greece, aided by the Greek partisans, Athens and all the Greek mainland had been cleared of the enemy.

(*e*) BURMA

> "*Along the Eastern Frontier of India stands the* 14*th British Imperial Army*. . . . *This Army under Admiral Mountbatten, amounting to between* 250,000 *and* 300,000 *men* apart from rearward services *which in that theatre of extraordinarily long and precarious communications are very great, this Army has, by its aggressive operation, guarded the pass of the American air line to China and has protected India against the horrors of a Japanese invasion*. . . . *The ten Japanese divisions that were launched against us with the object of invading India have been repulsed and largely shattered as the result of a bloody campaign*. . . . *The campaign of Admiral Mountbatten on the Burma Frontier constitutes the largest and most important ground fighting against the armies of Japan*. . . . *It constitutes the greatest collision which has yet taken place on land with Japan and has resulted in the slaughter of between* 50,000 *and* 60,000 *Japanese and the capture of several hundred prisoners*."
>
> RT. HON. WINSTON CHURCHILL, 28*th August*, 1944.

On 25th August, 1943, Admiral Lord Louis Mountbatten was appointed Supreme Allied Commander of the South East Asia Command, in charge of land, sea and air operations against Japan in South East Asia.

The front on which the British are now fighting in Burma extends some 700 miles and is second only in length to the Russian Front. Burma is the hard land crust which protects the Japanese conquests in China and South East Asia. It is Japan's land route to India and, more important, the Allies' land route to China. Both offensively and defensively the Japanese have strained every nerve to hold it.

British and Indian troops of the 14th Army decisively defeated the Japanese armies attempting to invade India. The enemy committed over two-thirds of his forces in Burma in this abortive attempt. The defence of Kohima by the mixed garrison which was there is one of the epic tales of the British and Indian Armies.

British and Indian troops of the Long Range Penetration Brigades, first under Major-General Wingate and later under Major-General Lentaigne, proved their ability to outfight the enemy in jungle warfare. They operated far behind the enemy lines, cutting his communications.

Perhaps the most striking single factor in the Burma campaign of 1943-4 was that, with the achievement of air superiority, the Allies were able to develop a new and highly effective form of jungle warfare, based on air transport and the dropping of supplies from the air. The operations of the Long Range Penetration Brigades depended entirely on aircraft for their transport and supply.

During the siege of Imphal, 2½ divisions were flown to Imphal and Dimapur to reinforce the garrisons there, and 30,000 non-combatant units flown out ; in the month of June, a daily average of 700 tons of supplies was flown into Imphal.

By the end of 1944, the Fourteenth Army had loosened the Japanese grip on the whole of Northern Burma. In March the land connection from India to China had been established, and by May, 1945, Mandalay and Rangoon had been captured and the annihilation of Japanese Forces in Burma was proceeding rapidly, 97,000 Japanese having been killed and 250,000 casualties inflicted.

About one-third of the Fourteenth Army were troops of the United Kingdom. In November, 1944, its total strength including rearward services was given as 750,000 men. It formed more than three-quarters of all the Allied ground troops fighting in Burma.

(*f*) NORTH-WEST EUROPE

> "*This is a glorious story, not only liberating the fields of France from atrocious enslavement but also uniting with bonds of true comradeship the great democracies of the West and the English-speaking peoples of the world.*"
>
> RT. HON. WINSTON CHURCHILL, 2*nd August*, 1944.

Preparations

Britain was the base from which the great Allied assault was launched on the Continent of Europe.

Preparations for D-Day began in the early days of 1942. These plans, worked out to the last detail, have resulted in the brilliant victories that followed.

In April, 1943, Lieutenant-General Morgan, of the British Army, was appointed chief of the joint planning staff which produced the plans for the Allied landings in Normandy, selected the beaches for the attack and presented the outline of the scheme together with a mass of detail to support it. At the Quebec Conference in August, 1943, this plan received, in principle, complete agreement.

Large areas of territory along the coast of Britain were cleared in order to provide the many battle-training grounds required by both British and American forces.

The control and organisation of equipment for the invasion forces took over a full year's work by the *Royal Army Ordnance Corps*.

The task of *waterproofing* all Allied invasion vehicles occupied the whole steel sheet capacity of the industries of Britain—280 factories—for 3 months. Some 250 lorries were engaged for 8 weeks in transporting the material from factories to R.A.O.C. depots ; each lorry covered the ordinary mileage of a year in those two months. The R.A.O.C. had the task of receiving, assembling and issuing to the fighting units approximately half a million components of some 5,000 different types which the factories had produced in record time.

Before D-Day over 60,000,000 gallons of petrol had to be filled into containers in Britain. More than 500 special trains were required to move them to stores.

The *Royal Signals*, in collaboration with the staff of the *General Post Office* planned and carried out a vast communications network, which involved 20,000 miles of high-grade circuits, provided as land-links for the extension of cross-Channel circuits to Service headquarters in this country.

The work of the *British Combined Operations Command*, founded in 1940 for the purpose of amphibious warfare, contributed greatly to the success of the Allied landings in France. The mass of knowledge accumulated from the British Commando raids on Lofoten, Spitzbergen, Vaagsö, Bruneval, St. Nazaire and Dieppe were invaluable when planning the combined Allied assault on France.

The *Home Guard* of Britain assumed the operational responsibility of keeping watch and ward in the United Kingdom during the crossing of the Allied Expeditionary Force to France. They released many regular troops for employment on other tasks essential to the success of the operation, thus playing a decisive and integral part in the re-entry into France.

The *prefabricated harbour* (Mulberry) built in the sea off Arromanches ranks as one of the most imaginative pieces of war engineering in history.

Experts at the British Admiralty and War Office were responsible for the design and the construction of the components which formed the artificial harbour which was a triumph of British industry and labour. All the units were built entirely in Britain by British labour and with British materials.

As a result of the skill of British experts, craftsmen and seamen, the Allied Armies with all their vital supplies were put ashore in the most rapid build-up ever achieved in warfare, in spite of the worst June gale for 40 years.

The prefabricated harbour made possible the liberation of Western Europe, not only by winning the battle of the build-up, but also by supplying and sustaining the advance from Falaise to the frontiers of Germany.

Operations

> "*The speed with which the mighty British and American armies in France were built up is almost incredible. In the first* 24 *hours a quarter of a million men were landed in the teeth of fortified and violent opposition. By the* 20*th day one million men were ashore. . . . There are now between* 2,000,000 *and* 3,000,000 *men in France. . . . I am glad to say that after* 120 *days of fighting we still bear in the cross-Channel troops a proportion of* 2 *to* 3 *in personnel and of* 4 *to* 5½ *fighting divisions in France. . . .*"
>
> RT. HON. WINSTON CHURCHILL, 28*th September*, 1944.

General Montgomery was Commander of all Allied ground forces under General Eisenhower up to 1st September, 1944, when he was promoted Field-Marshal.

British, Canadian and American forces of the 21st Army Group carried out the initial assault on France. " In the first stages of the invasion, the British and American forces were equal in size." The British 6th Airborne Division together with British Commandos played the vital part in establishing the left flank of the Allied positions.

The experience of land-air co-operation developed during the campaigns in North Africa, Sicily and Italy was applied in the operations in North-West Europe, where the close integration of Army-Air Power has never been surpassed in the history of warfare.

The pinning down of the German armoured divisions by the British 2nd Army was the key to General Montgomery's strategy which led eventually to the capture of Cherbourg and to the eventual break-through by the American 3rd Army at the western end of the line. Mr. Stimson, the U.S. Secretary of War, paid tribute to the British and Canadian troops on the eastern sector " for so engaging the enemy that he had no uncommitted strength with which to threaten the American corridor across the peninsula."

The British and Canadians by containing 7 out of 10 German armoured divisions in the Caen-Falaise area contributed greatly to the destruction of the German armies. Of the German stand in the Caen area, General Eisenhower said that every foot of ground the Germans lost at Caen was like losing 10 miles anywhere else.

After the spectacular advance of the Guards Armoured Division from Flers to Brussels—430 miles in 9 days—they were again the spearhead of the

British 2nd Army in the advance from Brussels to the Dutch Frontier and up to the German frontier near Nijmegen. On 3rd September they advanced 93 miles from Douai to Brussels. It was the longest and swiftest advance that any division of any nation has ever made in military history.

The British 1st Airborne Division was landed at Arnhem more than 50 miles behind the enemy's front line. General Eisenhower said that by fighting almost to extinction these airborne troops not only gave one of the most gallant examples of bravery, fortitude and courage in the history of warfare, but, by drawing to themselves all the fury of the German counter-attack, enabled the American 82nd and 101st Airborne Divisions to maintain their hold on the bridges behind them.

The operation at Arnhem was more than 85 per cent successful and the Allied Airborne invasion of Holland helped the military situation by driving a wedge 60 miles deep into a vital part of the enemy positions over flat country cut by canals.

Troops from the United Kingdom made up three-quarters of the Canadian First Army in the final campaign in North-West Europe, when it broke through the northern hinge of the enemy line covering the Rhine and turned the elaborate Siegfried defences.

When the time came for the final advance into Germany, the British Second Army forced the main Rhine crossing in the north against the determined and formidable opposition which the enemy had concentrated at a vital point, and broke through into the north German plain.

The dramatic culmination of a campaign which had carried 21st Army Group from the beaches of Normandy to the shores of the Baltic came on 5th May, 1945, with the unconditional surrender of the German armies in Holland, Denmark and N.W. Germany to Field-Marshal Montgomery. Over 1,000,000 Germans were involved.

4. THE ACHIEVEMENT OF THE ROYAL NAVY

Perspective

" It is upon the Navy, under the good providence of God, that the wealth, safety and strength of the kingdom do chiefly depend."

Britain is an island. It follows that incoming supplies for the sustenance of the war effort must be brought by sea and that ships once again must carry the troops, equipment and stores required for the launching and maintenance of overseas campaigns. The ships which bear this inward and outward as well as coastwise traffic must be protected against relentless enemy attack by surface craft, U-boats and mines and aircraft across many thousands of miles of sea and ocean.

Britain is the key base for the Allied attack upon Germany. It was from this base that the Royal Navy's blockade of Germany and German-controlled Europe was mounted and maintained, the German fleet contained and ship by ship destroyed, and that enemy coastal convoys were sought out and attacked ; that the African and Mediterranean campaigns were supplied and reinforced, and that innumerable combined operations were transported, landed and brought back. Finally it was from this base that, under the cover afforded by the Royal Navy and the R.A.F., the great armadas set forth which successfully accomplished the landings in North Africa and later the gigantic assault on North-West Europe.

All this and the escort of Arctic convoys to Russia have thrown an enormous strain on the men and ships of the Royal Navy who have had to spend long periods continuously at sea.

There has been a tremendous expansion in number both of ships and men in all branches of the service since the outbreak of war. New classes of vessels have been introduced.

In spite of having borne single-handed the whole burden of the war at sea for one and a half years after the loss of the French fleet to the Allies and before the United States entered the war, the Royal Navy has more than replaced the heavy losses it has inevitably sustained in the execution of its multifarious tasks and duties in all the seas and oceans.

As soon as the naval situation in the West permitted, a large and specially equipped Fleet was sent to the Pacific, in addition to the East Indies Fleet already operating in the Indian Ocean. The new British Pacific Fleet was in action by the end of March, 1945.

Performance

I. CONVOY PROTECTION

(a) General

> "*We must regard the struggle at sea as the foundation of all the efforts of the United Nations. If they lost that, all else would be denied to them.*"
>
> RT. HON. WINSTON CHURCHILL, *8th September*, 1942.

More than 220,000 British and Allied vessels in 9,000 convoys were escorted to and from the United Kingdom and in surrounding waters between September, 1939, and the end of 1944.

British ocean convoys in the same period totalled approximately 219,000,000 ship-miles. By 21st October, 1944, more than 350,000,000 tons of shipping had been convoyed across the Atlantic since the outbreak of war. Losses in convoy have steadily been reduced.

In 1941 one ship was lost out of every 181 which sailed in main North Atlantic and United Kingdom convoys ; in 1942, one out of every 233 ; in 1943, one out of every 344. In the last half of 1943 losses in these convoys were less than one ship in 1,000. In the 4 months ended 18th September, 1943, no merchant vessel was sunk by enemy action in the North Atlantic. During the first fortnight in September, 1943, no Allied ships were sunk by U-boat action in any part of the world. Losses continued to decrease in 1944.

On 21st October, 1944, it was disclosed that the largest supply convoy of all time—167 ships, loaded with more than 1,000,000 tons of cargo, and covering an area of nearly 26 square miles—had recently crossed the Atlantic from North America and arrived in British ports without loss.

* * * *

The Royal Navy, together with the Merchant Navy, saved the bulk of the British Expeditionary Forces in the evacuations from Norway, Dunkirk, Greece and Crete. And when the tide of war turned they played their part once more in landing the Allied Armies in Madagascar, North Africa, Sicily, Italy, Northern and Southern France and Greece.

The Royal Navy, from early 1940 until the summer of 1943, kept open, and constantly convoyed reinforcements to the Middle East by, the long Cape Route. This is a voyage of 12,000 miles ; that to India is about the same.

During the year ended 31st July, 1944, British ships brought to the United Kingdom some 865,000 uniformed Americans; of these 320,500 were carried in the great liners *Queen Mary* and *Queen Elizabeth* which have steamed nearly a million miles and carried 1,250,000 troops during the war. The safety of their passage depended upon the Royal Navy and Allied command of the seas.

By October, 1944, out of 10,600,000 soldiers who had been moved all over the world in our troop convoys, only 2,978 had lost their lives through enemy action at sea.

Convoys escorted by the Royal Navy, at great risk, to Malta and to Russia did much towards tiding the Allies over difficult periods in the parallel campaigns in Russia and North Africa and building up their power to hit back.

The round trip from the north of England to Archangel and back is about 6,000 miles counting deviations. This lies mainly within the Arctic Circle, between the pack ice and the enemy air and U-boat bases.

By March, 1945, since the commencement of these Russian convoys 16 British warships had been sunk on this duty, and in some periods there were very considerable losses of merchant ships. Yet, over all, 677 cargo ships and approximately 90 per cent of the cargoes consigned got through. Nearly 900 of H.M. Ships and approximately 260,000 men were involved in convoy escorts to Russia.

The work of convoy, patrolling and shipping protection involves great strain on men and ships alike, and some of them stay at sea for periods undreamed of in pre-war days.

H.M.S. *Cumberland* was at sea for 206 days out of a total of 213 from November, 1940 ; and from the outbreak of war up to 23rd February, 1943, this ship had steamed nearly a quarter of a million miles.

Between September, 1939, and February, 1943, H.M. Destroyer *Forester* steamed 200,000 miles, a distance equal to nine times round the world.

In a single year the corvette *Jonquil* steamed a distance equivalent to more than 3 times round the world.

In one year and four months H.M. Destroyer *Wolfhound* steamed over 50,000 miles and convoyed 3,000 ships.

From her commissioning in 1940 up to July, 1944, H.M. Destroyer *Havelock* steamed 300,000 miles.

Over the whole of the huge mass of shipping which entered the Mediterranean between 8th November, 1942, and 8th May, 1943, losses were less than 2¼ per cent, or 9 ships out of every 400.

In one year, from 4th October, 1943, to 4th October, 1944, 270 convoys of 3,700 merchant vessels of all types, of 25,104,067 gross tons, sailed from Naples and its satellite ports, together with 1,351 schooners engaged in inter-coastal trade. These figures exclude all Allied warships, together with all landing craft engaged on the regular shuttle service to Anzio between January and June, 1944, and more recently for the supply of the Army and Air Force through Civita Vecchia, Piombino and Livorno.

(*b*) Anti-Submarine Warfare

> "*There will not be in this war any period when the seas will be completely safe; but neither will there be, I believe, any period when the full necessary traffic of the Allies cannot be carried on. We shall suffer and we shall suffer continuously, but by perseverance, and by taking measures on the largest scale, I feel no doubt that in the end we shall break their hearts.*"
>
> RT. HON. WINSTON CHURCHILL, *8th November*, 1939.

In May, 1943, for the first time, the killings of U-boats substantially outnumbered their output.

From August to November, 1943, more U-boats were sunk than Allied ships were destroyed by U-boat action.

The number of U-boats sunk during the war had, by 8th May, 1945, exceeded 700 of which over 500 were accounted for by British Empire forces.

* * * *

In two months during the invasion of Northern France 17 U-boats were sunk while attempting to interfere with Allied cross-channel traffic. In spite of this, however, in the first month of the operations, though thousands of Allied ships were moved across the Channel and coastwise to build up the vast forces on the Continent, no merchant vessel of that great concourse was sunk by U-boat ; with the possible exception of one ship, which might equally have struck a mine.

The U-boat war, however, demands unceasing attention. Only the zeal and vigour of the Allied air and surface forces have procured the comparative safety of their shipping and the enemy's scant success.

(c) Minesweeping

> " *There are deliverances which we should never forget. There was the mining peril, the sea mining peril, which loomed so large in* 1939 *and which has been mastered by superior science and ingenuity and by the often forgotten but almost unsurpassed devotion to duty of our minesweeping crews and of the thousand ships they work and man that we may eat and live and thus fight for the good cause.*"
>
> RT. HON. WINSTON CHURCHILL, 22*nd February*, 1944.

The Minesweepers of the Royal Navy have played a most vital part in the safe arrival of convoys in all parts of the world. 20,000 mines have been swept in the coastal waters round Britain, in the Channel and North Sea, in the Mediterranean, in the Cape area and round the coasts of India and Australia.

By June, 1943, the number of mines destroyed in the swept channels would have been sufficient, if each one had been lethal, to destroy the whole British merchant fleet two and a half times over.

To clear the Sicilian Channel and open the Mediterranean so as to reduce the distance between Britain and Egypt by 9,000 miles, the 12th and 13th Minesweeping Flotillas of the Royal Navy each steamed 2,500 miles. They swept a channel of 600 square miles. In the course of this operation, which took a month, 257 mines were swept.

In all, about 4,000 mines of all descriptions were swept or destroyed by Allied Minesweepers in the Mediterranean, including the Ægean, during 1944.

H.M. Minesweeper *Bay's* crew claim that the *Bay* has sailed through the Straits of Dover more often than any other ship during the war. In early 1944 she swept her 240th convoy through and steamed her 20,000th mile.

B.Y.M.S. 2002, senior ship of the 150th Minesweeping Flotilla, has steamed 35,000 miles since her launching in March, 1942. This flotilla destroyed 130 mines in the course of recent operations and one sweep, yielding 22 mines, occupied 15 days, without any of the men of the flotilla going ashore.

II. OFFENSIVE ACTIONS

> "*The spirit of all our forces serving on salt water has never been more strong and high than now. The warrior heroes of the past may look down, as Nelson's monument looks down on us now, without any feeling that the island race has lost its daring or that the examples they set in bygone centuries have faded as the generations have succeeded one another.*"
>
> RT. HON. WINSTON CHURCHILL, 22*nd February*, 1944.

(*a*) Enemy Losses

During the 52 months of war up to 31st December, 1943, a total of 10,056,000 gross tons of enemy shipping was captured, sunk or damaged by surface ships, submarines, aircraft or mines ; more than 2,515,000 of which was sunk, captured or damaged during 1943 alone. (Losses inflicted on Japanese shipping and by Russian forces are not included.)

By May, 1942, apart from operations in the Far East, 86 per cent of the German and Italian surface warships so far destroyed, damaged or captured ; 89 per cent of all enemy merchant ships put out of action ; and 94 per cent of the enemy submarines destroyed by the Allies were sunk by United Kingdom forces.

Since the outbreak of war well over 150 German naval surface craft of all types, and over 130 Italian (excluding those probably sunk) have been sunk by British naval or naval air action.

Continuing throughout 1944 the offensive which they have maintained unremittingly since the first hour of the war, H.M. Submarines sank during the year at least 400 enemy ships of various sizes, ranging from coastal ammunition runners to large troop ships, tankers and merchant vessels. They also sank more than 23 Axis warships, including two cruisers, one of which was blown up by a human torpedo.

Up to 31st July, 1944, the number of enemy aircraft shot down by H.M. Ships was 674 confirmed, 222 probably destroyed and 330 damaged. During the same period naval aircraft destroyed 266, probably destroyed 44 and damaged 165.

From the outbreak of war up to 31st December, 1943, Light Coastal Forces of the Royal Navy had destroyed well over 100 enemy ships and by May, 1943, they were averaging one action per night. This pace has been kept up throughout 1944 in all areas. During the year 1944 in the Mediterranean theatre alone Light Coastal Forces destroyed a total of 76 enemy vessels, including a number of E-boats and other escorts and 33 supply ships.

* * * *

(*b*) Mediterranean

In the Mediterranean the Royal Navy in spite of numerical inferiority won every major action, including the great naval air attack on Taranto Harbour, and the historic Battle of Cape Matapan.

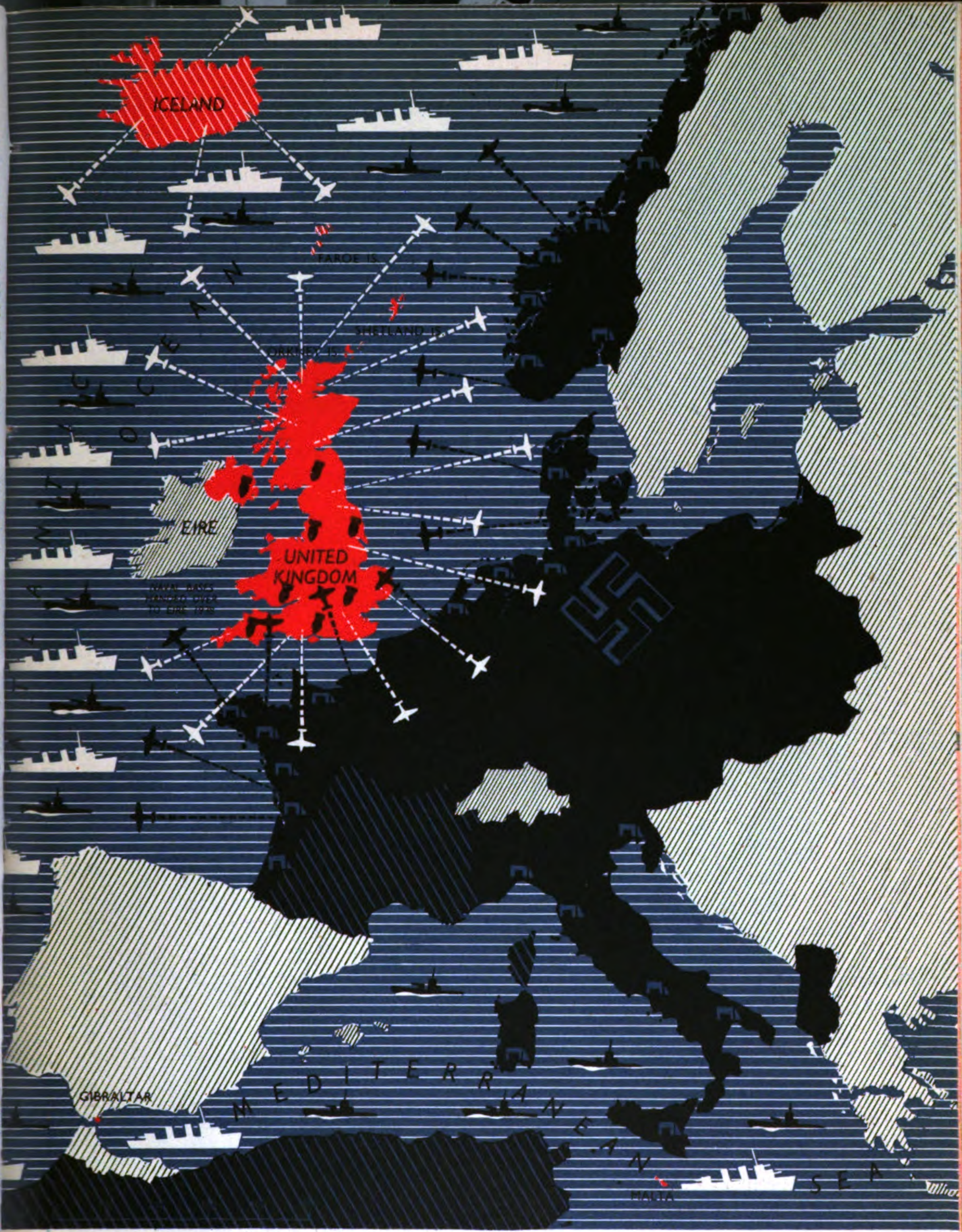
Not one British warship was sunk by an Italian surface vessel during the three years and more that Italy was at war with Britain.

In the 7 months following the occupation of French North Africa submarines in the Western Mediterranean sank 430,000 tons of enemy shipping and damaged 70,000 tons. Allied surface forces sank, or captured, 28 merchant vessels totalling 60,000 tons, 5 destroyers, 2 torpedo-boats and many smaller craft.

1,000,000 tons of Axis shipping had been sunk by British submarines in the Mediterranean by 23rd January, 1943.

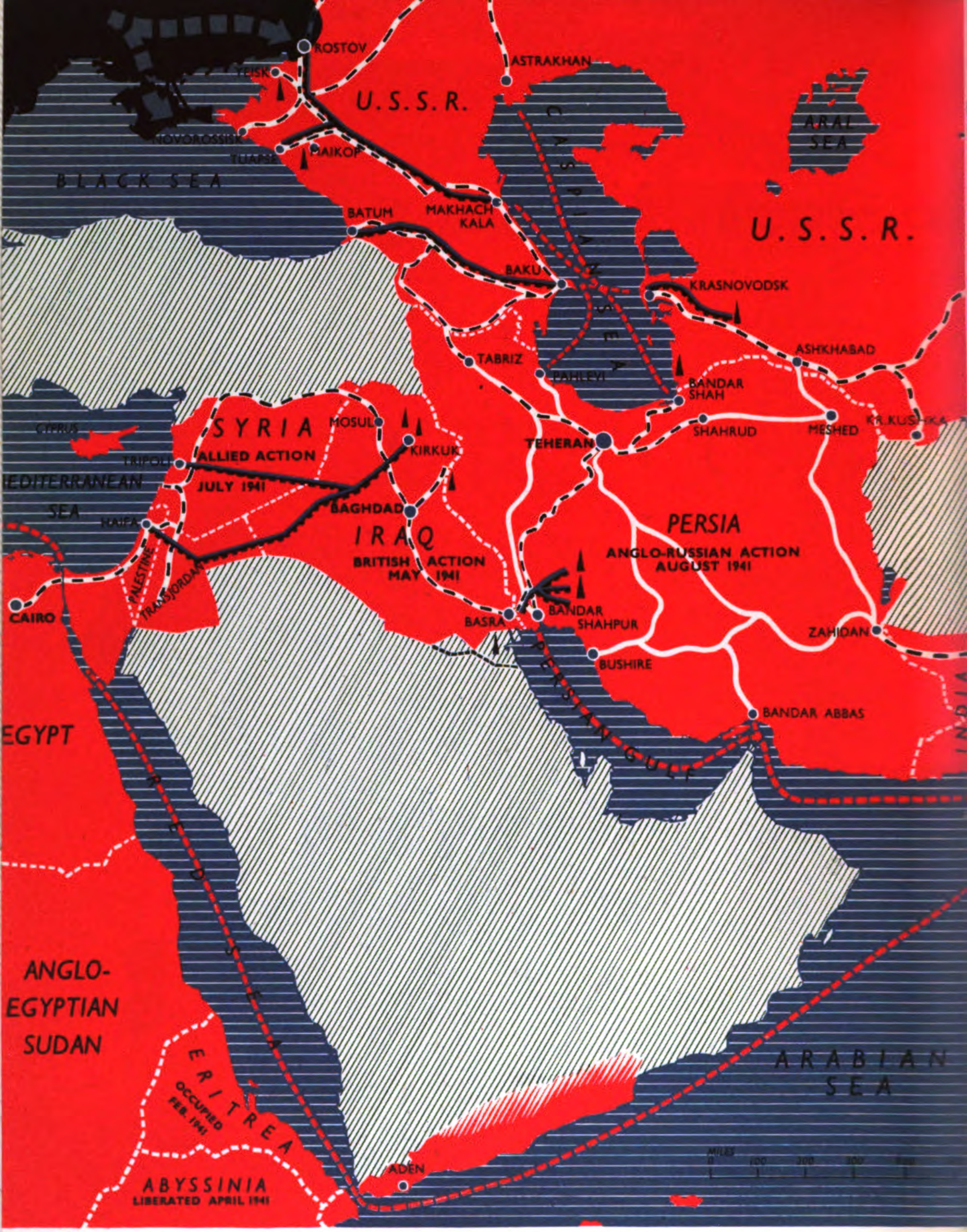
The victory of the British Fleet over the Italian was completed by the unconditional surrender of Italy. By November, 1943, the following ships of the Italian Navy were under Allied control ; 5 battleships, 8 light cruisers, 31 destroyers and torpedo-boats, 40 submarines and scores of smaller craft.

A task force of British escort aircraft carriers operated with much success in the Mediterranean in the summer of 1944. In 9 days off the Riviera in September aircraft from this force flew a total distance of 275,605 miles. Fighter-bombers went out on 532 sorties and the fighters flew 119 sorties in



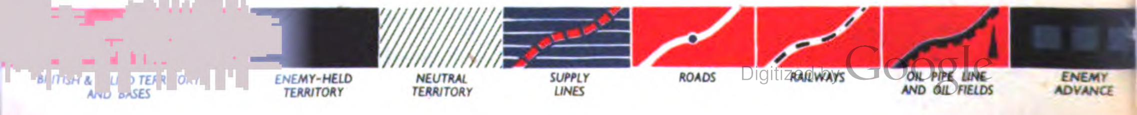
BLOCKADE, COUNTER-BLOCKADE 1940

By her march to the Atlantic, Germany hoped to break the British blockade of the Continent of Europe and to establish a counter-blockade of the British Isles. But the blockade against supplies to Germany was maintained, while the long and bloody battles fought by civilians, seamen, and airmen, kept open the sea routes to and from Britain, preserved the offensive base, and made certain the defeat of Germany.



SECURING THE MIDDLE EAST 1941-42

In 1941 Axis schemes forced the Allies to look to the security of the Middle East. In May pro-Axis plots in Iraq were defeated by British action, in July Vichy influence was expunged from Syria and the Lebanon by an Anglo-French force, and in August joint Russo-British action, with the co-operation of the new Persian regime, ensured the safety of the Persian routes. Thus the oil of the Middle East was secured to the Allies, the development of the Southern Route to Russia was assured, and the possibilities of joint German and Japanese machinations were forestalled.



spotting for naval bombardment, 84 on tactical reconnaissance, 114 on providing cover for the beaches, and 132 providing fighter cover over the task group.

In September, 1944, British and Allied warships began a campaign in the Ægean which speedily brought about the destruction or capture of all German or German controlled shipping in the area. The islands of Naxos, Lemnos, Karpathos, Santorin, Chios, Mytilene and Samos were cleared of the enemy by units of Land Forces Adriatic, leaving only the islands of Rhodes, Cos, Leros and Melos under German occupation. The garrisons on these remaining islands—equivalent to about two divisions—we virtually cut off from all supplies and reinforcements.

It was estimated in November, 1944, that the past year the enemy lost about 100,000 tons of shipping in the Ægean of an available total of 110,000 tons. Of these, 40,000 tons were destroyed by surface vessels, naval aircraft and submarines ; 33,000 by shore-based aircraft and 24,000 scuttled by the enemy to avoid capture. Between 9th September and 27th October Admiral Troubridge's fleet sank 31 enemy warships and transports of various sizes and 40 small craft. In addition 16 warships and merchant ships and at least 15 small craft were severely damaged ; naval aircraft attacked targets on the islands and on the mainland, bombardments were carried out, troops landed, and 3 islands surrendered to H.M. Ships.

* * * *

(c) Naval Support for Land Operations in the Mediterranean

The Royal Navy has rendered possible the great amphibious assaults of the Allies in African and Mediterranean waters. It was primarily responsible for the highly successful landings of Allied forces in French North Africa, and subsequently in Sicily, Italy, and Southern France.

850 ships, including 350 warships of all sizes, were engaged in the Anglo-American amphibious operation against French North Africa. Two out of the three major convoys sailed from Britain under the protection of the Royal Navy and Royal Air Force. Not a single life or ship was lost on the way.

3,000 ships of all kinds and sizes were engaged in the Anglo-American attack upon Sicily. In the initial assault 160,000 men, 14,000 vehicles, 600 tanks and 1,800 guns were transported.

The part played by naval gunnery in the assault upon Salerno in September, 1943, during which the naval guns turned the tide of battle in the Allies' favour, is but one example of the development of the use of warships as floating batteries for tactical co-operation with land forces.

During the critical period between 9th and 12th September between 6,000 and 10,000 shells of all calibres were being fired daily at targets in the Salerno area.

During the Sicilian campaign the Royal Navy subjected the island to more than 50 organised bombardments, and fired more than 20,000 rounds against selected enemy targets.

In the naval bombardment prior to the landings on the French Riviera in August, 1944, 15,900 shells, of which 12,500 were of over 12-inch calibre, were fired. The naval force operating in this area was estimated to comprise roughly 50 per cent British ships.

* * * *

(d) Actions in North European and Atlantic Waters (See also North-West Europe)

British warships with few opportunities have scored notable successes against the German fleet ; including the sinking of the battleships *Graf Spee* (13th-17th December, 1939), *Bismarck* (23rd-27th May, 1941), and the

Scharnhorst (26th December, 1943) ; and such actions as the destruction of 3 out of a force of 11 destroyers (without loss) by 2 of H.M. Cruisers in the Bay of Biscay on 27th and 28th December, 1943.

During the Norwegian campaign two major naval engagements took place in Narvik Fjord (10th and 13th April, 1940). As a result 11 German destroyers, 6 supply ships, and an ammunition vessel were sunk and 2 destroyers severely damaged, for the loss of 2 British destroyers, and damage to several others.

In September, 1943, British midget submarines delivered an attack of the utmost daring and damaged the German battleship *Tirpitz* in her very anchorage deep in Alten Fjord, Northern Norway. This was the first employment of British midget submarines.

The *Tirpitz* was subsequently attacked successfully by naval Barracuda aircraft in April and again in August, 1944. The attack on this ship was maintained in September with an assault by Russia-based Lancasters of the Royal Air Force. In October, the damaged ship was being moved from her anchorage in Kaa Fjord, and on 29th October she was again attacked by the R.A.F. west of Tromsö.

The *Tirpitz* was finally sunk in Tromsö Fjord on 12th November in an attack by two squadrons of Lancasters of R.A.F. Bomber Command. This action left Germany with no modern battleship that was operational and thus released British battleships for duties in the Far East.

(*e*) North-West Europe

> "*These operations were protected and supported by a considerable British Fleet assisted by a strong detachment of the American Fleet, the whole under Admiral Ramsay. In spite of gales, in spite of mines, in spite of more than* 100 *German submarines waiting, baffled, in the Biscay ports, and a swarm of E-boats and other marauders, ceaseless traffic has been maintained over the* 100-*mile stretch of Channel, and General Eisenhower, with his lieutenant, General Montgomery, now stands at the head of a very large and powerful army, equipped as no army has ever been equipped before.*"
>
> RT. HON WINSTON CHURCHILL, *2nd August,* 1944.

In the initial assault there were 5,143 ships and craft, of which 4,226 were landing ships and landing craft. Of the great fleet of warships over 20 were cruisers, and battleships, 7 of them, operated in the restricted waters of the Channel within range of enemy shore batteries.

During the first 4 weeks of the continental campaign no fewer than 1,000,000 men, 183,500 vehicles, and 650,000 tons of stores were landed in Normandy. During this period the average daily number of convoys going across the Channel was 16.

* * * *

Forerunners of the great armada were 200 minesweepers, manned by 10,000 officers and men, and carrying 2,800 tons of sweeping material. The oropesa sweepers, sweeping for moored mines alone, carried 70 miles of wire. 80 per cent of these vessels were British.

Between 6th June and 31st December, in the assault and subsequent operations east and west of the Seine Bay, over 1,700 mines were swept. Admiral Sir Bertram Ramsay said that in the first 3 months of the North-West

European campaign (6th June-6th August) the total number of mines swept by Allied ships represented 10 per cent of the mines swept in all theatres, during 5 years of war.

* * * *

After the minesweepers went the bombarding warships, bringing 800 guns (from 16-inch to 4-inch) to bear on the enemy. 2,000 tons of shells were fired in the first 10 minutes, 22,000 in the first 10 days.

By noon on D-Day H.M.S. *Warspite* alone had fired 175 rounds of 15-inch ammunition, amounting to some 150 tons.

The guns of the Fleet supported the Allied Armies until targets were too far inland to be within range, though the battleships engaged with accuracy at anything up to 30,000 yards. On one occasion a cruiser's guns were used in support of British infantry faced by a force of German Tiger tanks. The range was 20,000 yards, the leading Tigers were within 300 yards of the British infantry, but the cruiser's shells fell right among the enemy who were routed.

In 10 days of bombardment to help break up enemy concentrations massing around Caen, H.M.S. *Ramillies* fired over 1,000 rounds of 15-inch and 6-inch ammunition.

During the assault upon the strongly fortified island of Walcheren, in the Scheldt Estuary, H.M.S. *Warspite*, and H.M. monitors *Erebus* and *Roberts* bombarded the enemy positions at a fairly long range while small close support craft, manned by Royal Marines, pressed inshore to fire at point-blank range, affording magnificent support to the heavily opposed landings. Owing to weather conditions these operations had to be carried out without air support and very heavy losses were suffered among the landing and close support craft. But in spite of this the shore batteries were neutralised, which permitted the troops to gain a foothold, and the minesweepers to enter the estuary, thus was the vital port of Antwerp opened to Allied supply ships.

During the 7 months from D-Day to the end of the year, over 140,000 rounds had been fired by Allied warships in general support of military operations and over 8,000 in the bombardment of specified targets.

* * * *

More than 50 British warships, destroyers, frigates, and smaller craft, were constantly employed in the duty of screening and protecting convoys and bombarding warships, of patrolling against enemy attack and attacking the enemy convoys. They ranged over a sea area of 300 square miles and were involved in many actions, achieving some outstanding successes.

Most of the burden of the battle of the Channel in the first stages of the invasion of N.W. Europe fell upon the light coastal forces of the Royal Navy. In 14 days in August, coastal force units carried out 145 sorties and covered 28,600 miles. And in one week 19 enemy ships were sunk, 3 driven ashore and 28 damaged.

From 6th June to the end of 1944, 68 enemy ships and vessels from destroyers to small merchantmen were destroyed in operations carried out by the Royal Navy with the addition of Canadian and Polish destroyers and other Allied coastal craft, from the mouth of the Gironde in the west to Den Helder in the east.

* * * *

During the campaign in France much fine work was done by Obstacle Clearance and Harbour Recovery units. In 3 days an Obstacle Clearance Unit had made 2 miles of beach safe by the detonation of 2,400 mines and other obstacles and from June to December, 1944, 8 large ports were made serviceable by the work of the minesweepers and harbour recovery parties.

The Admiralty, in conjunction with the War Office, undertook the movement of the components of the prefabricated harbours to their assembly parks in the United Kingdom, the sinking of the caissons in the harbours, and the construction of the piers.

The Admiralty was responsible for the block ships, the floating breakwaters and the conformity of the caisson design with naval requirements as regards towing and seaworthiness, and for the final location of the equipment in the assembly parks. The Navy was also responsible for towing the equipment across the Channel ; though the general layout of the artificial harbours was a joint Admiralty and War Office responsibility.

This was an immense achievement, and when the first harbour was completed many thousands of tons of vital war material were unloaded each day. Even on the worst day of the worst June gale for 40 years, 800 tons of petrol and ammunition as well as many troops were landed over the piers.

* * * *

In conjunction with the landings in Normandy, an extensive series of mine-laying operations were carried out in enemy waters by minelayers of the Royal Navy, with aircraft of the R.A.F. By 17th October it was evident that over 100 enemy warships, auxiliaries and merchant vessels were sunk or severely damaged by British mines, 30 per cent of which losses were attributable to mines laid by naval forces.

* * * *

Without Britain's Navy, her Merchant Navy, and her command of the seas, the invasion of Europe would have been impossible. It was made possible by the winning of the Battle of the Atlantic, by the defeat of the U-boat, by mastering the mine menace, and by putting the German battle fleet out of action.

(*f*) The Far East

> "*For a year past, our modern battleships have been undergoing a further measure of modernisation and tropicalisation to meet the rapid war-time changes in technical apparatus. We had already, nine months ago, begun the creation of an immense fleet train...in order that our Fleet may have a degree of mobility which for several months together will make them largely independent of shore bases.*"
>
> RT. HON. WINSTON CHURCHILL, 28*th September,* 1944.

In August, 1944, the First Lord of the Admiralty disclosed that already 85 per cent of the work done in the Indian Ocean was being carried out by the Royal Navy.

In November, 1944, Admiral Sir James Somerville, head of the British Admiralty Delegation in Washington, announced that approximately 2,000,000 tons of shipping are now at sea in the Indian Ocean at any given time.

In the year 1944 alone H.M. submarines operating in Far Eastern waters had sunk one Japanese cruiser and 157 other ships, ranging from large supply vessels to anti-submarine craft. A Japanese aircraft carrier was hit by torpedo and believed to have been sunk ; and another Japanese cruiser was hit by torpedo.

As well as the successful British submarines in the Far East, and the Light Coastal Forces operating off Burma, a substantial number of larger units of the British Eastern Fleet, including battleships and aircraft carriers, operated with much success in the Andaman and Nicobar Islands and Netherlands East Indies areas during 1944.

Units of the Royal Navy have also attacked Japanese rail communications in bombardments of the coast of the Malay Peninsula, and raids have been carried out by Royal Marine Commandos in this area.

In December, 1944, the formation of two British eastern fleets instead of one was announced. These were the British Pacific Fleet, based on Australia, under Admiral Sir Bruce Fraser, and the East Indies Fleet, based on Ceylon, under Admiral Sir Arthur Power.

III. CASUALTIES

The Prime Minister announced on 22nd February, 1944, that " the total of personnel, officers and men of the Royal Navy lost since the war started is just over 30 per cent of its pre-war strength, the figures being 41,000 killed out of 133,000, which was the total strength at the outbreak of war," and which had multiplied many times since then. At the end of 1944 figures for naval casualties had amounted to 47,000 men killed or missing, 13,000 wounded, and 5,500 in prison camps.

The loss of ships, though heavy, has been more than replaced by new construction. Losses amount to 5 battleships and battle-cruisers, 8 aircraft carriers, 28 cruisers, 128 destroyers, 77 submarines and 52 sloops, frigates and corvettes.

5. THE ACHIEVEMENT OF THE MERCHANT NAVY

Perspective

Before the second world war, Britain's Merchant Fleet was the largest in the world, with a gross tonnage of about 17,500,000 tons (not including 3,000,000 tons of Dominion shipping) ; though even then U.K. tonnage was about one million tons smaller than it had been before the first world war. A very great strain was imposed upon the ships and the seamen in order to master the usual perils of the sea, as well as a strong and unscrupulous enemy, and maintain the supply of vital raw materials and foodstuffs without which the people of Britain could neither fight nor live. From the start, however, Britain applied her great experience in the organisation of coastal and ocean convoys, and her merchant seamen have maintained not only the British base, but the various fronts and garrisons established throughout the world, carrying aid also to Russia and playing an indispensable part in the combined operations which resulted in the successful landings in North Africa, Sicily, Salerno and France.

Performance

> "*Without your devoted service, there could be no victory for our arms. From the Master in command, to the boy on his first voyage, you have worked together with the steady discipline of free men who know what is at stake. Your reward is the consciousness of duty done and the affection and respect of all your countrymen.*"
>
> HIS MAJESTY THE KING, 25*th December*, 1943.

> "*The Merchant Navy, with Allied comrades, night and day, in weather fair or foul, face not only the ordinary perils of the sea but the sudden assaults of war from beneath the waters or from the sky. . . . We are a seafaring race, and we understand the call of the sea. . . . We feel confident that that proud tradition of our island will be upheld to-day wherever the ensign of a British merchantman is flown.*"
>
> RT. HON. WINSTON CHURCHILL, 31*st July*, 1941.

Over 2,000 merchant ships from the United Kingdom are at sea at any time.

It is to the ships and men of the Merchant Navy (as well as the Royal Navy) that hundreds of thousands of men of the Forces owe their lives and freedom after the evacuations from Norway, Dunkirk, Greece and Crete, and to the Merchant Navy that much of the credit must go for the successful landing and subsequent maintenance of the Allied Forces in North Africa, Sicily, Italy, North and South France.

In the first six months of war about 1,900 merchant vessels were armed, and during the first year nearly 3,000. By the beginning of February, 1943, 8,300 British and Allied merchant ships had been fitted with guns and other devices for their defence.

Fishing vessels and ships of the Merchant Navy alone had shot down 141 enemy aircraft, from 12th April, 1940, to the end of July, 1944; and had shared, with H.M. ships, the shooting down of a further 163 during the same period.

The tanker *British Confidence* steamed 243,000 miles in the first four years of war. Some of the large motor ships with a high speed have completed 300,000 miles in the same period.

Another tanker, the *British Judge*, steamed 20,000 miles with a hole as large as a medium-sized house in her side. This occurred in the Far East and she had to be taken by devious ways to Mobile, Alabama, for her extensive repairs.

23,000 military vehicles, some 1,300 aircraft, over 400,000 tons of military and air stores, and hundreds of locomotives were carried overseas by United Kingdom shipping in the single month of October, 1941.

300 ships were continuously employed during 1941 on the 12,000-mile voyage round the Cape to support British armies in the Middle East.

500,000 men, 50,000 tanks and other vehicles, and 1,000,000 tons of store, were carried round the Cape to destinations in the Middle East, India and the Far East, during 1942.

Over 3,000,000 tons of military stores, including 1,000,000 tons of food, had been landed in Egyptian ports up to April, 1942.

12,000 ships carrying over 77,000,000 tons of cargo had been convoyed from Canadian shores up to the middle of June, 1943.

* * * *

500,000 men and over 1,000,000 tons of stores were landed in North Africa in the first four months of the Tunisian campaign.

During the six months of the Tunisian campaign more than 1,000 merchant ships left the United Kingdom carrying a constant stream of millions of tons of supplies to the armies in North Africa.

* * * *

On 6th June, 1944, when 1,000 merchant vessels, manned by 50,000 seamen, crossed the Channel to Normandy, the Merchant Navy redeemed the promise it made as its ships left Norway, Dunkirk, Greece and Crete.

These ships had to be considered individually two years beforehand as to their suitability for the carriage of various types of cargo. The immense fleet had to be assembled, loaded, and finally convoyed across the Channel with its vital cargoes.

In the first three days following 6th June, 38 convoys had to get to France—some of from 90 to 100 ships. Nearly 750 of the major types of vessels were in these 38 convoys, excluding escorts.

It says much for the strength of Britain's Merchant Fleet that this colossal operation could be undertaken, and kept supplied and reinforced, while convoys still sailed across the Atlantic, in the Far North, and to supply the Allied armies in the Mediterranean.

It is by the ships of the Merchant Navy that the three-quarter million items in the range of the Army's fighting and technical stores and the three-quarter million items in the R.A.F.'s stores are moved.

Approximately 100,000 tons of shipping a year are required to transport a division of 20,000 men 1,000 miles overseas, with arms, equipment and stores, and to keep it supplied and reinforced.

16½ tons of spare parts must, it is estimated, be shipped overseas in order to keep 100 25-pounder guns in action for one year. One medium tank may need up to 2 tons of spare parts in a year.

Every bomber sent overseas requires, it is calculated, a total of 1,000 tons of shipping space to carry the personnel, petrol, bombs and spare parts necessary to put it into operation. All these have to be carried by ships.

* * * *

One of the boldest achievements of the Merchant Navy was the maintenance throughout the winter of 1943-4 of a service by sea between Sweden and Britain. A fleet of small, powerful vessels successfully ran the German blockade in the Skagerrak, transporting valuable cargoes and carrying the Red Ensign into Swedish waters for the first time in three and a half years.

* * * *

There have been many individual acts of bravery in Britain's Merchant Navy, and from the outbreak of war up to 31st December, 1944, more than 6,300 ship-masters, officers and men had received awards.

During five and a half years of war 30,589 Merchant seamen in British ships lost their lives, 4,215 were wounded, 690 missing, and a further 4,088 were interned by the enemy.

In February, 1944, Mr. Churchill said that since the beginning of the war the proportion of merchant seamen hailing from the British Isles alone who have been lost at sea on their vital duty, has been about one-fifth of the average number engaged in this service.

The loss of merchant ships has been equally heavy. By 8th May, 1945, 2,570 British ships of nearly 11½ million gross tons had been lost. Though these losses were partly offset by new construction, purchase and organisation, the British ocean-going Merchant Fleet had been reduced to 13½ million gross tons at the end of 1943. The situation, however, improved in 1944.

6. THE ACHIEVEMENT OF THE ROYAL AIR FORCE

Perspective

At the outbreak of war the Royal Air Force was much smaller than the Luftwaffe, prepared as it was for aggression. But the Royal Air Force was of the highest quality. The victory of British fighters in the Battle of Britain was a victory, not only for British fighting prowess but also for British scientific technique and foresight. Similar foresight developed the heavy bombers and, in 1939, initiated the great Commonwealth Air Training Plan, to provide the crews to man the bombers. Thus, after Fighter Command had saved Britain from German invasion in 1940, Bomber Command was able to launch an ever-mounting aerial offensive against the industrial centres of the Reich, thereby depriving the enemy of the opportunity to build up his reserves, compelling him to divert aircraft from the battle fronts for home defence, to such an extent as to leave his armies without adequate air cover. At the same time, units of the R.A.F. operating with Allied armies in North Africa, Sicily, Italy, North-West Europe, the Balkans, Eastern Mediterranean, India and Burma have led the way to new heights of land-air co-operation. Meanwhile, and all the time, a greatly strengthened Coastal Command has played a decisive part in defeating the U-boat menace.

Performance

(*a*) Fighter Operations

> "*Never in the field of human conflict was so much owed by so many to so few.*"
>
> RT. HON. WINSTON CHURCHILL, 20*th August*, 1940.

The Royal Air Force decisively defeated the Luftwaffe in the Battle of Britain. On five separate occasions during August-September, 1940, over 100 enemy aircraft were shot down in a single day ; on 15th August, 181 were destroyed, and on 15th September, 185. During the whole period of the Battle (8th August—31st October, 1940) 2,375 enemy aircraft were destroyed in daylight by British fighters and anti-aircraft fire ; the R.A.F. lost 733 aircraft and 375 pilots killed.

After beating the Luftwaffe in the Battle of Britain, Fighter Command moved into the offensive. British fighters swept over the Low Countries and France and defeated the Germans over their own airfields. More than four out of every five enemy aircraft destroyed by British-based fighters in 1943 were shot down on the enemy's side of the English Channel.

Two German aircraft were destroyed for every British fighter lost in all operations during 1943.

The total number of sorties made by aircraft of Fighter Command in five and a half years of war was over 700,000.

During 1944, Fighter Command destroyed over 700 German aircraft, more than 500 of them at night.

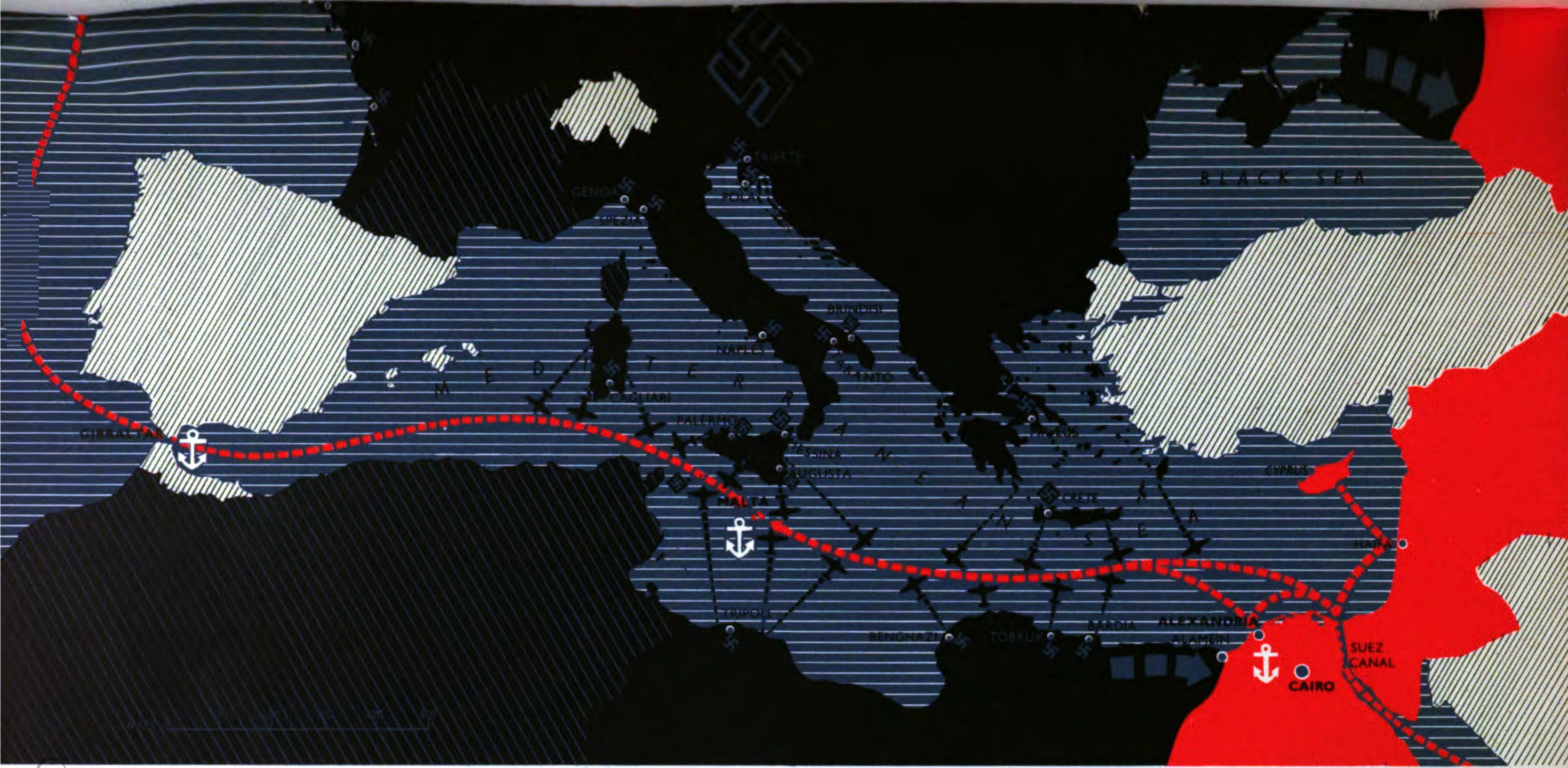
Over 20,340 enemy aircraft were brought down by the Royal Air Force and Dominion and Allied squadrons serving with it, and by the United States Air Forces, or by British anti-aircraft fire, between September, 1939, and 31st May, 1944, over the United Kingdom, continental Europe, the Mediterranean, the Middle East, India and Burma. This figure includes at least 1,086 aircraft brought down by naval and merchant vessels or by the Fleet Air Arm, but does not include more than 6,500 destroyed by the 8th and 9th U.S.A.A.F.s based on Britain, nor the large numbers destroyed on the ground—well over 3,000 in the Mediterranean area alone. Axis losses in North-West Europe for the first 70 days after 6th June are given on p. 27.

Fighter operations in connection with the campaign in North-West Europe are outlined elsewhere (see p. 27).

In 1944 fighter aircraft operating under the Air Defence of Great Britain, and balloons, played an outstanding part in the defeat of the flying-bomb attacks on London and Southern England.

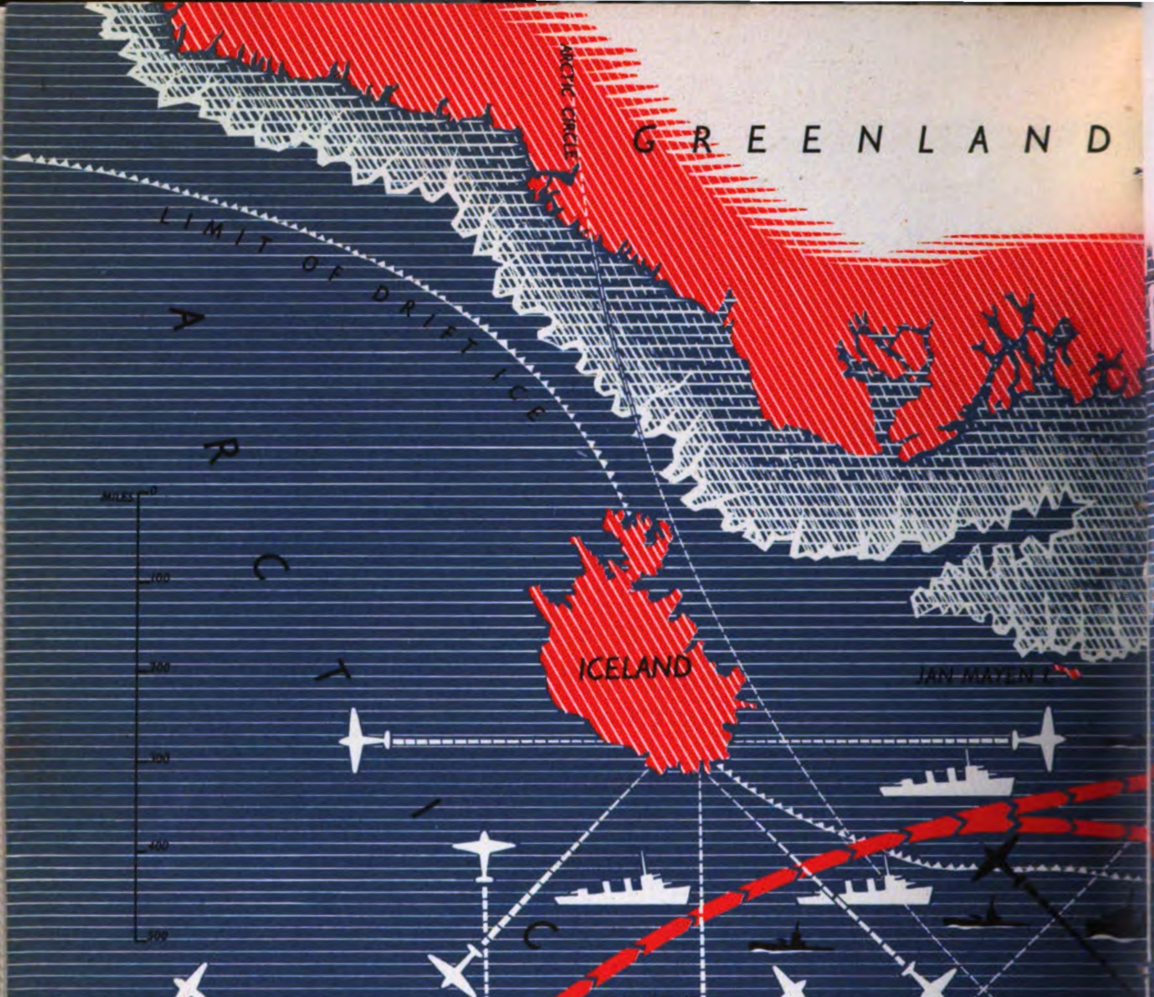
In approximately 80 days up to the end of August, 1944, the enemy launched some 8,000 flying bombs against this country. Of these 2,300 or 29 per cent got through to the London region; 25 per cent were erratic, and 46 per cent were brought down by the defences. These consisted of an arrangement of balloon, gun and fighter belts.

The guns, numbering 800 heavy and nearly 2,000 light guns and 20 American batteries, brought down 1,560 bombs. Balloons, numbering nearly 2,000, brought down 279—nearly 15 per cent of all the bombs which entered the barrage area. Fighters brought down a further 1,900 ; after about a month's



MEDITERRANEAN BASIN SITUATION 1941-42. BEFORE EL ALAMEIN

1942 was a year of crisis in the war second in gravity only to 1940. Japan was driving West, Germany East. The German drive had two arms, one across Southern Russia, the other across North Africa. This vital threat to Allied strategy was defeated in the twin victories of Stalingrad and El Alamein. To the resounding victories in Africa which followed, the sturdy resistance of Malta throughout her long siege greatly contributed.



🟥 BRITISH & ALLIED TERRITORY

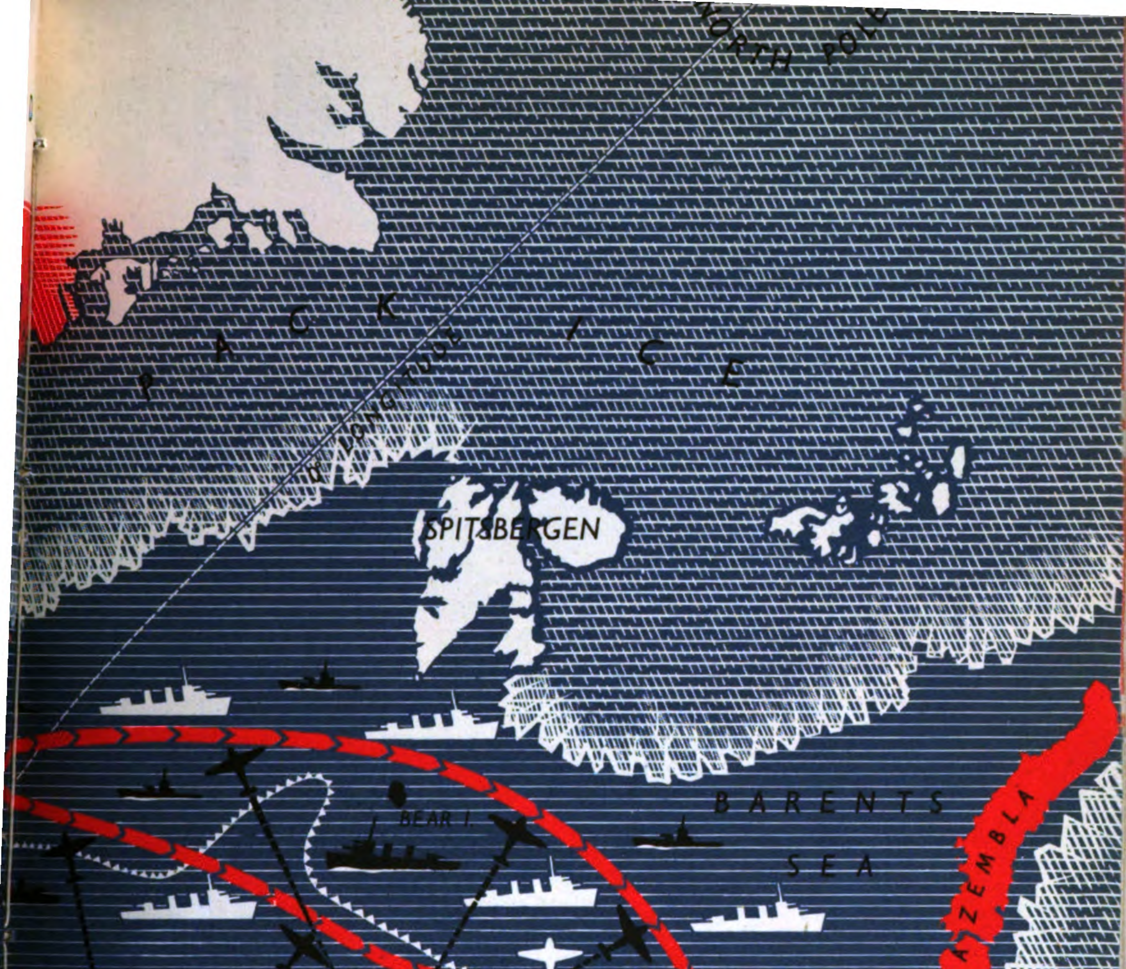
▨ BRITISH & ALLIED BASES

■ ENEMY AND ENEMY-HELD TERRITORY

▨ NEUTRAL TERRITORY

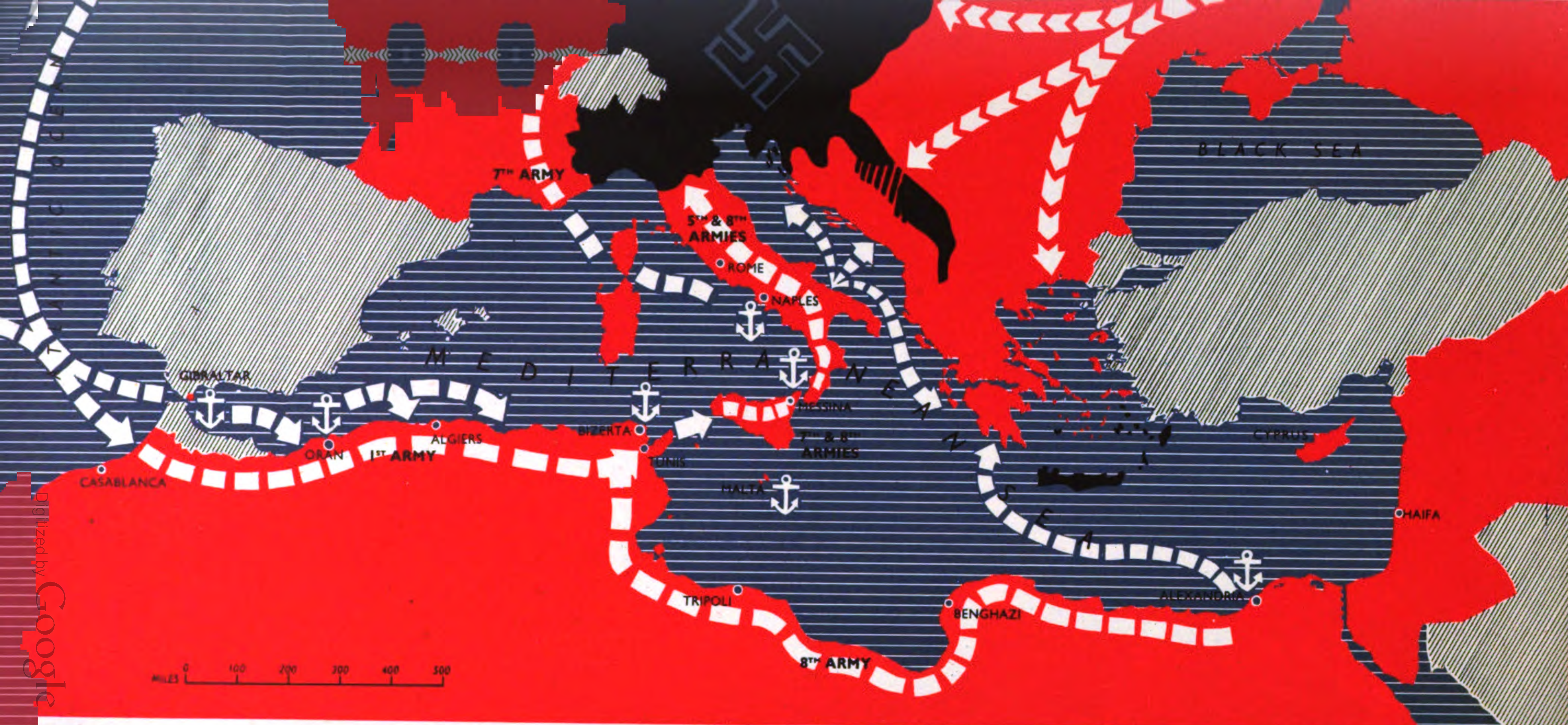
CONVOYS TO RUSSIA,

The pledge of unstinted aid to Russia was given i
cutting to the bare minimum supplies to the arme
they were pressed through the narrow and dang
Norway, in waters infested by the enemy's surfac
aircraft. But these convoys helped to save Russia



HE ARCTIC ROUTE 1942

mediately the German assault became known. By
forces and for civilian use the goods were found;
ous channels between the ice and the cliffs of
d underwater craft and constantly watched by his
d to add power to her return blows at the Reich.



MEDITERRANEAN BASIN AND SOUTHERN EUROPE. SITUATION 1943-44

The tremendous victories in North Africa and in the Mediterranean which Britain had initiated and in which she was engaged at the side of her American and other Allies, opened the way for the liberation of Rome by the brilliant generalship of Field-Marshal Alexander and for the invasion of Southern France and the Balkans. At the same time, the Mediterranean became a vital supply route for ensuring the defeat of Japan.

experience they were destroying at least 80 per cent of their sightings. The best day for the defences was 28th August when, out of 101 bombs which approached the coast, 97 were brought down.

(*b*) Coastal Operations

> "*I cannot speak too highly of the skill, the courage and the endurance which the crews of Coastal Command have shown in succouring convoys and developing offensive operations against the U-boats. The past twelve months* [1943-4] *have witnessed not only a global expansion of the Command, but also an increase in the proportion of very-long-range aircraft which are able to provide cover for convoys hundreds of miles out to sea and even right across the North Atlantic.*"
>
> RT. HON. A.V. ALEXANDER, FIRST LORD OF THE ADMIRALTY,
> *7th March*, 1944.

By December, 1942, Coastal Command already had more aircraft than the entire R.A.F. possessed at the outbreak of war.

Aircraft of Coastal Command from the outbreak of war to May, 1945, had flown well over 180,000,000 miles and 1,350,000 hours.

Over 30,000,000 miles were flown in 1943 alone, of which 25,000,000 were flown on anti-U-boat operations.

In 1943, Coastal Command destroyed more U-boats than in three previous years' operations put together. By February, 1944, more than 900 attacks on U-boats had been made by Coastal Command aircraft.

Over 5,300 convoys, excluding naval convoys and single ships, were escorted by Coastal Command during the first three and a half years of war. This entailed more than 31,000 operational sorties.

During 1944, aircraft of Coastal Command sank some 40 merchant ships, 3 destroyers and at least 40 other vessels ; 50 more merchant ships, 3 destroyers and a great number of other vessels were damaged. The number of merchant vessels sunk and damaged is almost double that of the previous year.

During June, 1944, aircraft of Coastal Command flew nearly 8,000 sorties—treble the number flown in June, 1943. Over 600 vessels of all types were attacked. From D-Day to the end of the year, over 8,000 anti-shipping sorties were flown by aircraft of the Command.

In the three months July to September, 1944, Coastal Command put in well over 87,000 flying hours on anti-U-boat operations alone.

At least 80 per cent of the advance information required in planning the Allied landings in Normandy was provided by the aircraft of the Photographic Reconnaissance Group of Coastal Command.

(*c*) Bombing Operations

> "*It is an unfailing source of strength to us and, I well know, to our brothers-in-arms of the* 8*th U.S. Bomber Command, to realise, as we do, that every bomb which leaves the racks makes smoother the part of the armies of the United Nations as they close in to the kill.*"
>
> AIR CHIEF MARSHAL SIR ARTHUR HARRIS,
> A.O.C., R.A.F., BOMBER COMMAND.

During 1944, R.A.F. Bomber Command dropped more than 525,000 tons of bombs. This is more than twice the weight dropped in the first four and a quarter years of war, up to December, 1943. More aircraft were despatched on operational flights than in all the previous years of the war put together, yet the casualty rate was well under half of what it was in 1943. The total weight of bombs dropped by Bomber Command on Europe, from the outbreak of war to 5th May, 1945, was 955,040 tons. The total number of sorties was 392,137.

The whole operational strength of the long-range bomber force of the Luftwaffe is now only a quarter of what it was in June, 1940 ; R.A.F. Bomber Command, on the other hand, can now drop nearly 20 times the tonnage which it was capable of dropping in June, 1940.

The greatest weight of bombs dropped in one night of 1944 was just under 5,500 tons ; the greatest weight dropped in 24 hours was 10,300 tons. In one period of 18 hours in October, 1944, Bomber Command despatched over 2,600 aircraft.

Britain's heaviest bomb in 1944, weighed 5½ tons, approximately 24 times heavier than the heaviest bomb used in March, 1940. It was then by far the heaviest and most powerful bomb in the world ; it makes a crater 100 ft. across and will penetrate at least 12 ft. of concrete. In March, 1945 the use of a 10-ton bomb was announced.

In 24 hours, Bomber Command aircraft have dropped more than twice the tonnage of explosives that the Germans dropped on Britain in four and a half months of flying-bomb attacks, and half as much again as the weight of bombs dropped on London in the ten months of the " blitz."

Bomber Command fought three great battles over Germany in 1943, and took part in two great Allied campaigns in 1944 : these were the battles of the Ruhr, of Hamburg and of Berlin ; the pre-invasion smashing of the enemy's communications system in North-West Europe, and the Anglo-American air offensive against the enemy's fuel supplies.

The battle of the Ruhr began with a heavy attack on Essen on 5th-6th March, 1943 ; six months later, 50,000 tons of bombs had fallen on this vital industrial area. The battle included the breaching of the Möhne and Eder dams on 17th May, which released 336,000,000 tons of water and caused floods extending for 50 miles.

Some 10,000 tons of bombs were dropped on Hamburg by R.A.F. and U.S.A.A.F. bombers between 24th July and 3rd August, 1943, and three-quarters of the city was devastated.

The battle of Berlin began on the night of 18th November, 1943, and by the end of March, 1944, Berlin was the most heavily bombed city in the world, well over 33,000 tons of bombs having been dropped upon it by the R.A.F. alone.

In April, 1944, the Allied Air Forces began their great assault on the enemy's communication system in North-West Europe ; R.A.F. Bomber Command contributed 20,000 tons of bombs to this campaign.

In June, 1944, Bomber Command took up its part in the joint Anglo-American oil offensive, concentrating on the 10 synthetic oil plants in the Ruhr. By September, 1944, these were all out of action, and by December, despite constant repairs, were all out of action again.

In addition to strategic bombing, heavy bombers of the R.A.F. have played an important and extremely effective tactical role, by direct intervention in the land battles in North-West Europe. Some of these operations are indicated below (see p. 28).

Despite these tremendous commitments, over 10 per cent of the total effort of Bomber Command has, on an average, been engaged in mine-laying operations ; 47,000 mines laid by Bomber Command probably sank over a million tons of enemy shipping. Mine-laying operations in 1944 were on a far greater scale than in any previous year of the war.

(*d*) Air Operations in connection with the campaign in North-West Europe

> "*Preparations definitely began for the battle in April, not only at the point of attack, for that would have revealed much, but necessarily and impartially all along the coast and far in the rear. Thus, when our ships crossed the Channel, unseen and unmolested, half the guns that were to have blown them out of the water were already dismantled or silent, and when the counter-attack began on land and under the sea, the tactical and coastal forces held it back while our footholds on shore and our sea lanes were being firmly established.*"
>
> RT. HON. WINSTON CHURCHILL, 2*nd August*, 1944.

In the three months April–June, which saw the preparation and launching of the invasion of Europe, 7,000 men of the R.A.F. Home Commands alone were killed or posted missing.

Allied Expeditionary Air Force

The 2nd British Tactical Air Force, and R.A.F. Fighter Command compose, together with the 9th U.S.A.A.F., the A.E.A.F. operating under Supreme Headquarters, Allied Expeditionary Forces.

The following are some outstanding records, chiefly of the two British components.

In the month of June, 1944, aircraft of the A.E.A.F. flew approximately 90,000 sorties—by far the greatest monthly aggregate ever so far recorded by a single Command in the history of air warfare. Nearly a quarter of the sorties were concerned with providing cover for the Allied beachheads in Normandy ; on many days more than 1,000 aircraft patrolled the landing area. The 2nd British Tactical Air Force alone flew 34,000 sorties out of this total.

In one week, 7th-15th August, the 2nd Tactical Air Force flew 8,665 sorties, more than 5,700 of which were in direct support of the Allied armies; 10,500 rockets were launched by rocket-firing fighters during the week.

On 18th August, aircraft of the 2nd Tactical Air Force intercepted a large concentration of German armour and transport attempting to escape encirclement in the Falaise pocket, and took record toll of it, accounting for more than 2,800 vehicles and 200 tanks destroyed or damaged—equal to the combined results of the eight previous best days.

The total destruction caused by A.E.A.F. fighter-bombers and fighters to the German army during August, 1944, amounted to : 873 tanks, 12,441 motor transport vehicles, 1,413 locomotives, 5,926 railway wagons, and 406 river barges.

In the first 70 days of operations in France, 2,990 enemy aircraft were destroyed in the air and 651 on the ground ; Allied aircraft losses of all types totalled 2,959.

During the first five days of the airborne landings in Holland R.A.F. fighters flew more than 1,400 sorties, about 1,250 of which were in direct support of the ground forces.

From D-Day to the end of 1944, one group of the 2nd Tactical Air Force destroyed more than 200 enemy aircraft at night over the western front.

In all, aircraft of the 2nd Tactical Air Force fired over 150,000 rockets, dropped some 62,000 tons of bombs on German ground forces and communications, and flew approximately 300,000 sorties in close support of the Allied armies, from June, 1944 to May 8th, 1945.

R.A.F. Bomber Command :

During the night of 5th-6th June, 1944, 1,300 aircraft of Bomber Command dropped well over 5,000 tons of bombs on 10 coastal batteries in the Normandy landing area.

In the month of June, 1944, well over 56,000 tons of bombs were dropped by the R.A.F. ; over 50 attacks were made on key railway and road points, and 21 coastal batteries were bombed.

The following are two outstanding examples of the close tactical support given by Bomber Command to Allied ground forces on many occasions during the fighting in North-West Europe : on the morning of 18th July more than 1,000 heavy bombers dropped 5,000 tons of bombs on enemy positions east of Caen in less than 45 minutes, as a prelude to an advance by infantry. On the night of 7th-8th August, a similar force dropped 3,500 tons of bombs on enemy positions astride the Caen-Falaise road ; this was the first time heavy bombers had operated in close support at night, yet the support was even closer than in previous daylight operations.

Between 1st-12th September, Bomber Command flew 2,042 sorties against Havre, and dropped 9,500 tons—5,000 in one daylight raid alone. The saving of manpower thus effected was shown by the army casualties—400—for the taking of the port, with 11,000 prisoners.

With advent of the war to German soil the massive blows of Bomber Command against the strategic industrial and communications centres of the Reich frequently also serve important tactical ends. For instance, on 16th November, 1944, over 1,150 heavy bombers of R.A.F. Bomber Command, escorted by more than 250 fighters, were despatched to attack Düren, Julich and Heinsberg, three fortified towns east and north-east of Aachen, in direct support of American troops ; over 5,600 tons of bombs were dropped in one of the greatest air operations of the war, and photographs showed a concentration of bomb craters almost without parallel in any previous attack by the R.A.F.

(*e*) Air Operations in connection with Mediterranean and Burma Campaigns

These campaigns were also remarkable for the co-ordination of air operations with those on land and on sea. Air operations, both tactical and strategic, contributed materially to the success of the campaigns in North Africa, Sicily, Italy, the Balkans and Burma. A few figures selected out of many statistics available illustrate this.

Over 20,000,000 lb. of bombs were dropped on enemy objectives in North Africa between 8th November, 1942, and 7th May, 1943. On one day alone (6th May) more than 2,500 sorties were flown and 1,250,000 lb. of bombs dropped. More than 7,600 Axis aircraft were destroyed in all the Campaigns in North Africa—5,156 of these in combat and 2,500 destroyed or captured on the ground.

The Allied advance up the Italian peninsula was well supported throughout by the Mediterranean Allied Air Forces. To quote only one example, the German armies retreating north from Rome were constantly harried by the Desert Air Force ; in less than a month about 10,000 motor vehicles were wrecked on the roads.

In all during 1944, R.A.F. and Dominion aircraft of the Mediterranean Allied and Middle East Air Forces flew some 218,000 sorties.

In August, 1944, the R.A.F. Balkan Air Force was created to support Marshal Tito's and other operations in the Balkans, and to organise the evacuation by air of sick and wounded partisans. From Yugoslavia alone, over 1,300 were evacuated during the months June-November.

The rapidity of the German ejection from Greece and their flight through the Balkans were largely due to the support given by R.A.F. Spitfires and transport aircraft.

In this connection may also be mentioned the highly successful mining of the Danube carried out by R.A.F. Wellingtons and Liberators from Italy. This seriously restricted German supply traffic on this great inland waterway, at a time when the position of German troops in the Balkans was becoming increasingly precarious.

The achievement of air superiority enabled the Fourteenth Army and Allied Forces to develop a new form of jungle warfare based on air transport and the dropping of supplies from the air. The transport and maintenance of the Long Range Penetration Brigades (" The Chindits ") was one striking example of this. The maintenance by air of the garrisons in Manipur, the reinforcement by air of the garrisons at Imphal and Dimapur with 2½ divisions and the evacuation of 30,000 non-combatant units from these areas provided further evidence of the contribution made by the air forces to the success of the campaign.

From May to October, 1944, inclusive, right through the monsoon, Allied aircraft of the Combat Cargo Task Force of Eastern Air Command flew 25,049 sorties and delivered 76,169 tons of supplies.

(*f*) Transport Command

Transport Command at the beginning of 1945 was flying nearly six million track miles a month over its world-wide network of 80,000 miles of scheduled air routes. Its aircraft were covering more than a million miles a month over the North and South Atlantic alone.

During 1944 transport aircraft of the Command's Mediterranean Group alone achieved a total of 25,000,000 ton miles, carrying a total of 247,000 passengers. In addition thousands of aircraft were handled by ferry pilots on their way to war fronts in Italy and Burma.

In little over five months since D-Day, one Group of R.A.F. Transport Command flew more than 20,000,000 lb. of supplies to forward airfields on the Continent and transported 14,000 service personnel across the Channel ; more than 5,000 airborne troops were dropped or landed by gliders behind the enemy lines. In addition, 4,000 panniers containing urgent supplies were dropped to troops on the ground, and hundreds of jeeps, motor-cycles, anti-tank guns and other war materials.

One Transport Command airfield in Belgium has, in one month, received 3,438 aircraft, handled more than 7,000 tons of freight, received and despatched 4,280 passengers, and evacuated 7,200 casualties.

In one week, an Air Supply Group of R.A.F. Transport Command flew more than 1,800,000 lb. of freight and 48,000 lb. of mail for the troops to the Western Front ; more than 66,000 lb. of mail and 1,290 casualties were brought home in the same period.

From D-Day to VE-Day No. 46 Group R.A.F. Transport Command flew 13½ million miles, carried 33,000 tons of mail and freight and transported or evacuated 258,00 passengers and casualties. In twelve months, during 1944-5 the Command flew 50,000,000 air miles and 374,000,000 passenger miles.

THE ACHIEVEMENT OF THE CIVIL DEFENCE SERVICES

> "*The courage of Londoners, and the organisation of our many defence and municipal services under unexampled strain, not only enabled us to come through what many might have thought a mortal peril, but impressed itself in every country, upon the minds of every country in the world.*"
>
> RT. HON. WINSTON CHURCHILL, 14*th July*, 1941.

Perspective

London is 15 minutes by air from the French coast, till lately under German occupation. That was the constant background for more than four years. The men and women of the Civil Defence services were the front-line fighters of the British people when they successfully withstood the enemy's onslaught from the air during the Battle of Britain. At the time of the blitz 50,000 high-explosive bombs were showered down upon London between the beginning of September, 1940, and the end of July, 1941. The number of fire-bombs dropped was far larger.

These men and women have again become front-line fighters with the launching of V-bomb attacks against London and Southern England. From the middle of June, 1944, up to 6th September, over 8,000 of these bombs had been launched. Rocket bombs have also been fired against Britain.

Performance

London was bombed every night except three from the 7th September to the end of November, 1940. Yet life and war-work within the capital were never fatally interrupted. This was due in great measure to the men and women of the Civil Defence services—wardens, firemen, police, rescue squads, drivers, nurses and auxiliaries.

There were 324,000 men and 59,000 women in the whole-time Civil Defence services in 1941. In the following year 20,000 additional women had released an equivalent number of men for national service elsewhere.

In addition there were 1¼ million men and 350,000 women giving part-time service.

Nearly 10,000 fires were attended to by the London fire brigade and their reinforcements during the first 22 days and nights of the blitz. More than 4,600,000 men and women civilian fire-guards were organised in 1941 to counter the enemy's fire-raising tactics.

3,000 incendiary bombs were dropped and 20 fires were started in one very sharp raid on a town on the south-west coast. Fire-guards dealt with these so effectively that the National Fire Service had to be called out only to two of these fires.

Some 31,000 instructors have been trained in special schools for Civil Defence. More than 40,000 instructors have been engaged in training fire-guards.

The system of water supply was so efficiently maintained during the blitz that no cases of typhoid occurred. Hygiene was so well maintained that despite the crowding of London's air-raid shelters there was no increase in disease.

Between September, 1940, and September, 1941, Post Office engineers repaired, in the London Region alone, 1,700 cables, 3,000 joints, and 500,000 wires.

During the blitz the Post Office was still handling 10,000,000 packets and 500,000 parcels daily.

Out of 13,000,000 houses in the United Kingdom 4½ million had been damaged or destroyed by bombs from the start of war up to September, 1944. That is nearly one out of every three houses in the country. Of this total 202,000 were totally destroyed, and a further 255,000 rendered uninhabitable.

3,500 mobile volunteers have been formed into a labour corps known as the Special Service Flying Squad. This squad, housed and fed in travelling caravans, supplements local resources in severe air attacks. It has dealt with more than 160,000 cases of intensive repair to bomb-damaged houses, and industrial objectives.

After one raid on towns on the east coast of Scotland flying squads of repair-workers got on the job with such effective dispatch that families who had to leave their damaged houses were back within a few hours.

Nearly 14,000 churches and other ecclesiastical buildings, 1,103 schools and about 500 hospitals had been destroyed or damaged in Great Britain, up to September, 1944.

Very many of Britain's provincial cities suffered greatly in the blitz. Plymouth, for instance, was savagely bombed by the Germans five times between 21st and 29th April, 1941. Many Civil Defence depots and posts were demolished or damaged and there were numbers of casualties among the personnel. During April, 27 of the wardens alone were killed or seriously injured. But Civil Defence carried on in Plymouth, and on the last night of the April attacks 12,000 citizens were organised and brigaded as fire-bomb fighters, apart from the unorganised volunteers. Other cities severely damaged during 1940-1 were Bristol, Cardiff, Birmingham, Sheffield, Manchester, Liverpool, Glasgow, Nottingham, Leeds, etc.

Since November, 1942, there have been numbers of sharp raids on British towns, including London, Canterbury, Aberdeen, Great Yarmouth, Sunderland, Cardiff, Brighton, Bournemouth, Torquay, Grimsby, Hull.

At the time of the great blitz on Coventry roughly 80,000 people were working in that district. It took only 14 days to get 77,000 of them back to work.

After eight nights of blitz on the docks at Liverpool, every shift was working in about three days after the attack had ceased.

Up to the end of 1943, 2,889 decorations and commendations for bravery had been made to members of the Civil Defence services in Britain.

One warden in every six during the Battle of Britain was a woman. The women of Britain know about war. So do many of the children, because when war came to Britain it was total.

In all between June, 1944 and March, 1945, over 9,000 flying bombs were launched against Britain. In addition, 1,050 rockets fell between September, 1944 and March, 1945.

During the first three and a half months of the flying-bomb attacks, about 25,000 houses were totally destroyed and over 1,000,000 received damage. In one period of 80 days damage was done to 140 schools, 103 churches, 98 hospitals and 112 public-houses.

When the flying bombs arrived, only 21,000 men were at work on repairs in London. Now there are 132,000 ; of these 44,900 have been brought in from the provinces. In London alone 258,849 houses had been repaired by 19th December, 1944, and 719,300 were scheduled for repair during winter.

Under the official evacuation scheme, re-introduced since the start of the flying-bomb attacks, more than 755,000 mothers and children were evacuated from London and Southern England.

Civil Defence Rescue workers have received constant and intensive training in scientific methods of rescue, with the result that the average time taken to extricate a victim from a wrecked building has been reduced by more than half, compared with the days of the "blitz." A quite considerable number of members of the National Fire Service have also received this training. Some British troops, Home Guards, U.S. troops and members of other Allied forces have been given the rudiments of the training.

Whole-time workers of the National Fire Service have also made an important contribution to the war effort when they are not actually fire-fighting and training. They do work on fire-stations, static water apparatus, public lighting, etc. In rural areas they help in harvesting, and in towns they have done a great deal of productive work on camouflage-netting, parts for sten-guns, etc.

8. THE ACHIEVEMENT OF BRITISH ECONOMIC WARFARE

Perspective

The object of all economic warfare—acting continuously in one form or another — is to limit and, if possible, break the economic power of the enemy to keep fighting. Thus it forms an important part of the total war effort. Britain has, accordingly, since 3rd September, 1939, carried on co-ordinated economic warfare against the whole process of Germany's productive capacity —supplies of materials, output of arms and machines, transport facilities, general organisation, manpower and stamina. This warfare is conducted by two chief means : first, the limitation through naval blockade of the flow of goods and raw materials to the enemy, combined with special commercial and financial measures in neutral countries ; and secondly, the direct destruction of enemy supplies, transport, and means of production by aerial bombing. The British blockade cuts off German-dominated Europe from vital sources of supply overseas, especially the rich areas of the Far East temporarily controlled by the Japanese. The financial and commercial measures include : restriction of imports from overseas to neutral countries in Europe to fit their domestic requirements only, so that there should be no surplus which might find its way into German hands ; in so far as these countries have domestic surpluses which the enemy needs, the taking of steps to buy them up (pre-emptive purchase) ; and the blacklisting of enemy firms so as to limit the scope of their activities. The blockade leads to tightening-up of the enemy's economy, creating strains and reducing its flexibility. This increases the effectiveness of the direct bombing attacks at selected key-points in German industry (e.g. synthetic oil) and transport. Both the blockade and air attack have done much to accentuate Germany's main weakness—shortage of manpower.

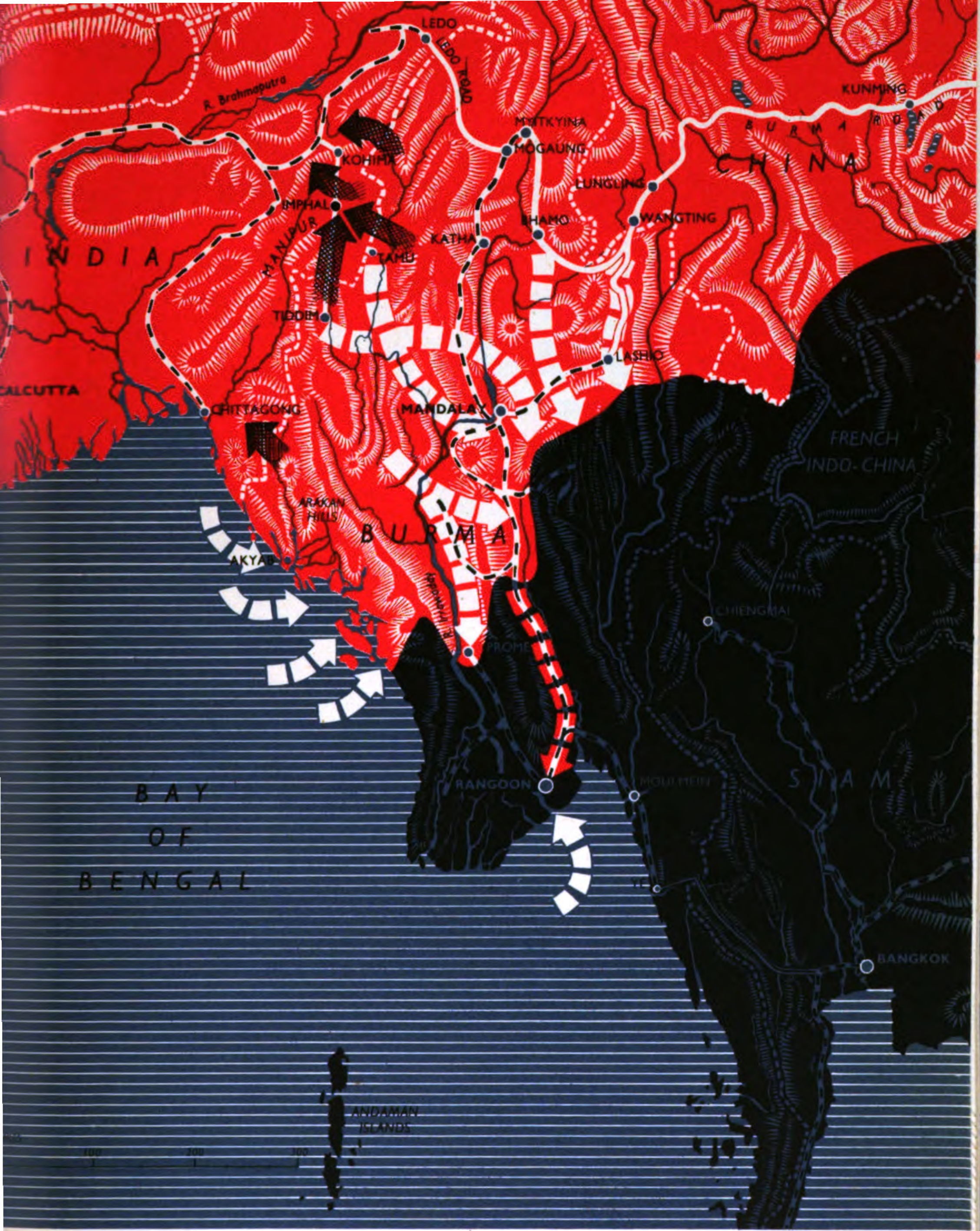
All the Allies are participating in economic warfare, but Britain's contribution has been unique. From the very first day of the war the blockade has been in action, causing an unspectacular, but continuous and cumulative strain on enemy resources. It had already been applied for over two years before America entered the war. Since the beginning of 1942, U.S.A. has been adding an ever-increasing weight, particularly in the air attacks on the enemy which had reached new high peaks of intensity in 1944. Similarly, the Russians—since the middle of 1941—have not only forced the Germans to sacrifice vast numbers of men and enormous supplies, but have also prevented them from obtaining in the U.S.S.R. the means of countering the effects of the blockade and air attack in the west. The citizens of enemy-occupied territories, too, have played their part by carrying out sabotage and adopting "go slow" methods of war. But underlying all these efforts of her Allies lies Britain's achievements—consistent since September, 1939—upon which the economic warfare of the other United Nations could be based and co-ordinated with her own in a concerted effort.

Performance

(*a*) Blockade

> "*Nearly all the German ocean-going ships are in hiding and rusting in neutral harbours, while our world-wide trade steadily proceeds.*"
>
> RT. HON. WINSTON CHURCHILL, 12*th November*, 1939.

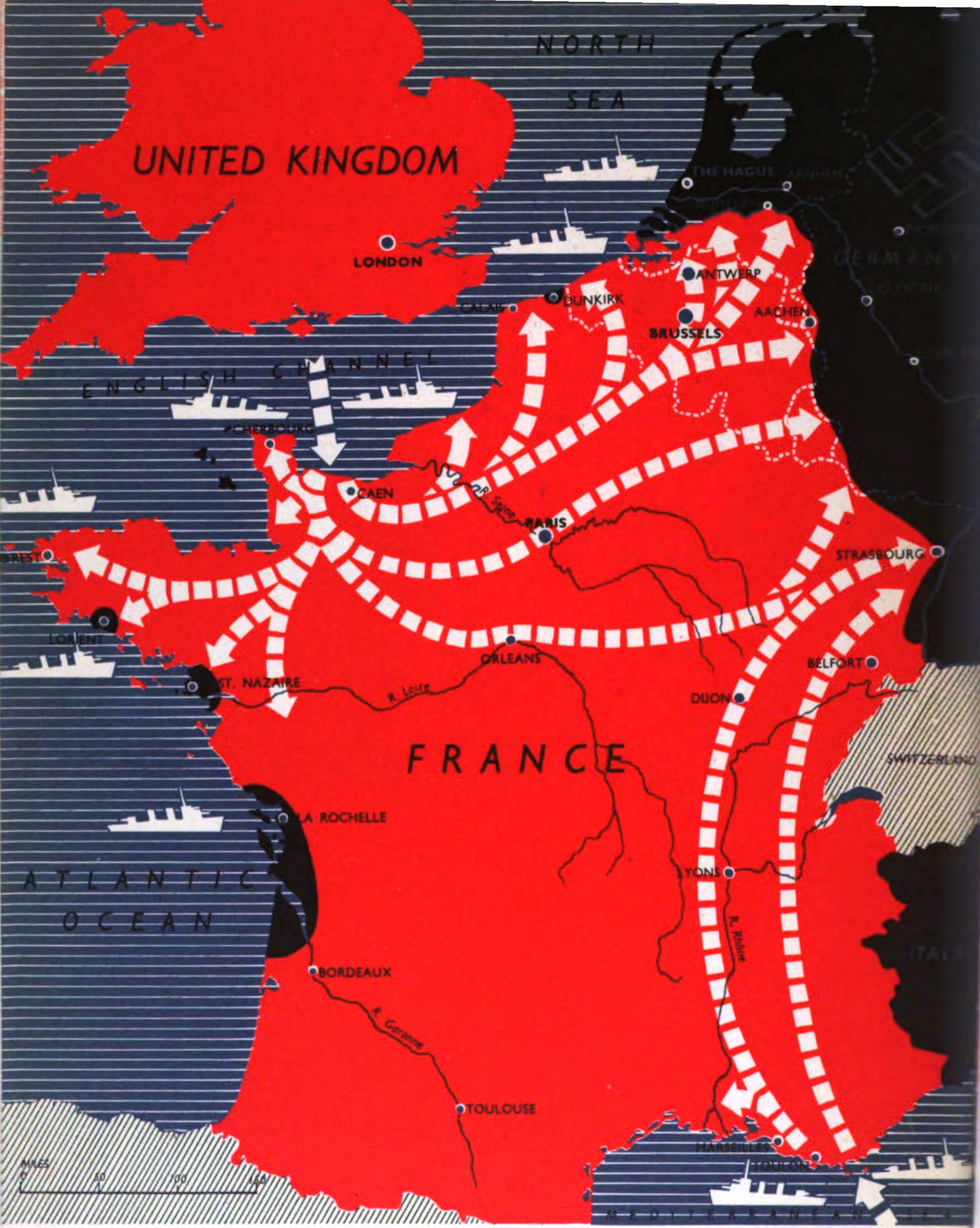
The blockade has virtually cut Germany off from all non-European sources of oil imports, all her natural rubber, about three-quarters of her copper, practically all her cotton and over two-thirds of her wool requirements.



THE BURMA FRONT

The invasion of Burma completed for Japan the blockade of China and gave her a base for her intended invasion of India. Burma became the principal land front for the Western Allies against Japan. The British Fourteenth Army, which numbered 750,000 during 1944, fighting in appalling conditions of climate and vegetation, had nevertheless by the end of the year finally removed the threat to India, and in 1945 broke the Japanese blockade of China. Throughout 1943 and 1944 the Burma campaign was putting an almost intolerable strain on Japanese shipping and thus largely contributing to Allied victories in the Pacific.

ITISH & ALLIED & ERATED TERRITORY on May 3, 1945
ENEMY-HELD TERRITORY as on May 3, 1945
RAILWAYS
RAILWAYS IN ENEMY HANDS
PROBABLE ROUTE OF RAILWAY BUILT BY P.O.W.
ROADS
ATTEMPTED INVASION OF INDIA
BRITISH & ALLIED ADVANCES



WESTERN FRONT, 15th DECEMBER 1944

From the first day of the war Britain had prepared herself as an offensive base against Germany and had endured endless discomforts and much bloody suffering to maintain the integrity of the base. After months of devastating air attack against the enemy, the reward came in June 1944, when she saw her own forces and those of her Allies launched at great hazard, but with complete success, against the formidable defences of the Nazis' Fortress of Europe.

🟥 BRITISH & LIBERATED TERRITORY
⬛ ENEMY & ENEMY-HELD TERRITORY
▨ NEUTRAL TERRITORY
🟦 MAIN AREAS OF NAVAL ACTIVITY
➡ BRITISH & ALLIED ADVANCES

The constant factor of the blockade forced Germany to rely on limited sources of ferro-alloys—used for toughening steel—(chrome, nickel, manganese, tungsten and molybdenum) and has thus accentuated the importance of recent developments affecting their supply, i.e. the loss of Nikopol, the bombing of Knaben, and the loss of Turkish and Spanish imports. About 80 per cent of Germany's nickel supplies were cut off by the blockade and proportionately greater use had to be made of manganese and molybdenum in certain alloys. The supply position of molybdenum has, however, constituted a major problem since the only European source of any significance is Norway, and the bombing of the Knaben mines (putting them out of action for several months), which accounted for over three-quarters of Germany's current supplies, has seriously impaired the situation. There are no important tungsten deposits in German-occupied Europe and supplies from the Iberian peninsula, which left no margin for reserve stocks, were greatly reduced in June, 1944, when Portugal agreed to prohibit further exports, and supplies from Spain were also reduced.

The effect of the blockade on the oil position has been two-fold. First, it had undoubtedly handicapped operations at the fronts, and secondly, compelled the Germans to depend more on synthetic production, with the consequent diversion of labour and materials. Shortage of lubricating oils has contributed to deterioration of rolling stock and affected industrial production.

The sealing off of all supplies of natural rubber has meant a great expansion in synthetic rubber production, but, quite apart from the fact that this is more expensive in labour and materials than the production of goods to pay for the import of the natural product, in many cases the quality of the substitute is inferior. Recently, the Germans have been forced to manufacture tyres for military purposes entirely of buna, although this means a great decline in durability and an increase in wastage.

It is estimated that the production of all substitutes including buna use up about one-quarter of Germany's total electricity output as well as a considerable proportion of her labour force.

The interception of enemy blockade-runners by the Royal Navy resulted in the sinking of 7 out of 11 inward-bound blockade-runners in the period November, 1942, to April, 1943, and in the almost complete failure from the enemy's point of view of later attempts.

British pre-emptive purchases denied Germany all chrome from Turkey from 1940 to the early part of 1943, and in April, 1944, Turkey agreed to the cessation of all chrome exports to the Reich.

Britain has bought up all the surplus woollen goods in Turkey and in Spain. The consequences of this action were experienced by the German armies on the Russian front, particularly in the winter campaigns. In all pre-emptive purchases Britain and the United States have acted in complete co-operation.

The British Statutory List (the Black List) has successfully immobilised enemy firms in countries overseas. Germany and her agents have been prevented from availing themselves of the foreign assets of their satellites and the enemy-occupied countries by effective freezing measures.

The principal effect of the blockade on agricultural policy has been a greater concentration on such crops as oilseeds (to make up for the shortage of fats) and roots—crops which require considerable care and have probably used up more valuable labour. It is estimated that the numbers employed in German agriculture have increased by one million on the pre-war figure, as a result of the impossibility of obtaining overseas supplies.

Over 95 per cent of the pre-war requirements of natural phosphates were imported, and allocations of phosphoric fertilisers even before the North African campaign were only one-third of normal consumption. Since then, Germany has been dependent upon basic slag as a source of phosphoric acid. In July, 1944, it was announced that only 18 per cent of the peace-time consumption of phosphate fertilisers would be allowed to farmers for the year 1944-5. On 30th November the ration was reduced to as little as 6 per cent of pre-war consumption—no doubt a consequence of the cutting off of Lorraine iron ores from the smelting of which Germany had been obtaining her basic slag.

The Royal Navy has successfully prevented sea traffic between Germany and Italy, and Germany and the Balkans. This has forced the enemy to make greater use of railways and inland waterways, instead of sea transport.

Negotiations by the Allies with the Swedish Government secured (on 18th August, 1944) the withdrawal of marine insurance for all Swedish ships sailing to any Axis port whatsoever, thus in effect imposing a complete embargo on their shipowners. Moreover, on 27th September, the Swedish Government closed all their own Baltic ports to German shipping.

The effect of the Swedish Government's action is to deprive the Germans of the bulk of their remaining imports from Sweden, the most important of which is iron ore, of which 60-65 per cent has been carried in Swedish ships. Some shipments may of course still leave Narvik, but the total quantity of ore to have reached Germany in 1944 was about one-third less than the quantity contracted for under the trade agreement, and less than 50 per cent of what the Germans actually received during the whole of 1943. The cutting of the Dortmund-Ems canal contributed to the reduction in iron ore reaching the Ruhr.

During the course of 1944 representatives of Great Britain and the United States reached an agreement with the Swedish concern, S.K.F., whereby exports of ball-bearings to Germany were substantially reduced. On the 15th October it was announced by the Swedish Foreign Office that these exports had been entirely stopped.

Another result of negotiation has been the Swedish decision to end tne export to the Axis of machine tools, special tools and chemicals.

British control of the English Channel by minelaying and patrolling has prevented practically all enemy commercial traffic passing through the Straits of Dover.

In short, the continuous blockade has compelled the Germans to use large quantities of materials and labour in the production of substitutes for normally imported goods and in the policy of increased self-sufficiency in foodstuffs, and has thus reduced the supply of labour available for other war production. The blockade is a long-term operation which has paved the way for the present disintegration of the German economy.

(*b*) Bombing Operations

> "*We know, not merely what factory has been hit, but which shop in the factory, and what it was producing... we can read some at least of the reasons why Germany has no longer abundant manpower and materials to throw into the offensive; repair and defence must have first claim.*"
>
> RT. HON. SIR ARCHIBALD SINCLAIR, 29*th February*, 1944.

It is estimated that, as a result of Bomber Command's 96 major attacks on 29 industrial towns in Germany between 1st March and 31st December, 1943, the German war industry suffered a loss of some 2,400,000,000 man-hours. The towns selected manufactured more than half the electrical engineering products, machine tools and rubber products, and nearly half the aero-engines made in the whole of Greater Germany. The loss of man-hours inflicted by Bomber Command represents 30 per cent of their potential output during the whole year.

Nearly two-thirds of Krupp's armaments works at Essen was damaged in attacks between March and July, 1943, resulting in a loss of at least six months' production ; some 10 million square feet of floor space were affected.

In the spring of 1944 it was estimated that production in Berlin, the enemy's largest single manufacturing centre, was at least 40 per cent below what it was in the previous year.

By the end of 1944, 13 major German industrial centres had each received 10,000 tons of bombs, and the total area of industrial devastation in Germany had reached at least 36,000 acres.

The bombing of Germany's heavy industrial concentrations by the R.A.F. had another effect complementary, in particular, to the attacks of the 8th U.S.A.A.F. on the German aircraft industry. It deprived the enemy of the means of rebuilding his destroyed fighter factories, and caused profound dislocation throughout the whole structure of the industry.

Another important objective of the Anglo-American bombing offensive was the German ball-bearings industry, with its vital relationship to every category of war production. As a result mainly of bombing, it was estimated in March, 1944, that the output of ball-bearings was only 50 per cent of that of the previous summer.

Another form taken by the Allied air attacks against the German war economy, is that against the German transport system. A tremendous weight of bombs has been and is being dropped on German railway centres, seriously reducing their over-all traffic capacity, destroying rolling stock and locomotives, and with them, their repair facilities. The destruction of rail installations is particularly serious for Germany, as she has lost, in Nikopol, her main source of manganese, of which a high proportion is required in the manufacture of points.

As well as inflicting heavy losses on what may be described as Germany's railway capital, the bombing of the German transport system results in the slow paralysis of her industrial machinery. This in its turn must seriously impede such projects as the movement of factories underground to escape from bombing.

At the same time, the enemy is being denied the possibility of making good his losses in railway capacity by the use of inland waterways. The mining of the Kiel Canal shortly before D-Day resulted in its being closed for over a week, and it was estimated that 1,350,000 metric tons of cargo were held up at a very critical time. The embankments of both the Dortmund-Ems and Mitteland Canals have also been cut by bombing, and stretches of 16 and 15 miles respectively of the canals drained. This meant that inland waterway communications between the Ruhr and the Rhine on one hand, and North, Central and Eastern Europe on the other, were effectively cut for some time.

In April, 1944, the Anglo-American Air Forces opened what has been described as the first major air attack, with adequate resources, upon the economic vitals of an enemy power. This was the attack on Germany's oil supplies—or more specifically, upon the refineries and synthetic oil production plants under German control.

About one-third of German Europe's total oil requirements were met by the refineries of the great Rumanian oilfield at Ploesti. When the Russians entered Ploesti in August, 1944, it was found that the output of Rumanian oil had been reduced to less than a third of what it had been four months previously, as a result of bombing.

Rather more than another third of Germany's oil supplies come from her synthetic oil plants, and the rest from new oilfields in Germany, Austria and Hungary. By constant bombing of these plants and refineries, it was estimated in September that production was less than 25 per cent of capacity before the offensive was launched. By March, 1945, synthetic oil output had dropped to 10%.

The German reaction to this offensive is significant. Over-riding priority has been given to the repair of the affected plants, and permanent repair camps have been built alongside the major synthetic oil plants. Hardly a drop of oil is being used in German war industry ; all industrial vehicles run on producer gas. There is evidence that military operations, both on the ground and in the air, are definitely being handicapped for lack of fuel.

9. THE ACHIEVEMENT OF BRITAIN'S AID TO HER ALLIES

Perspective

This war is being fought on the principle of mutual aid and the pooling of resources. Generous American lend-lease became translated into mutual aid when the United States entered the war. This was confirmed by Britain's mutual aid agreement with the United States in February, 1942. It was estimated in November, 1943, that mutual aid expenditure by Britain currently amounted to 10 per cent of Britain's war expenditure. The nature of Britain's reciprocal aid makes it impossible to give complete money values.

Nor does mutual aid cover the whole of overseas expenditure. Pay of troops and expenditures in third countries are outside its scope. Britain has borne a particularly heavy share of this burden. Up to the end of June, 1944, the United Kingdom had sold overseas assets to the value of £1,065 million and incurred liabilities abroad amounting to over £2,300 million.

The total of Britain's mutual aid, as recorded, exceeds £1,000 million. This has been given in furtherance of the principle that the resources of the United Nations should be pooled for the common war effort.

Performance

(*a*) To the United States

> "*These two great organisations of the English-speaking democracies, the British Empire and the United States, will have to be somewhat mixed up together in some of their affairs for mutual and general advantage.*"
>
> RT. HON. WINSTON CHURCHILL, 20*th August*, 1940.

Britain has, notwithstanding the lend-lease arrangement, spent over £1,500 million in the United States on supplies of all kinds since the outbreak of war.

In September, 1940, Britain leased to the United States for 99 years without charge naval and air bases on British island possessions in the Western Atlantic ; this in return for the most timely gift of 50 over-age American destroyers.

About 56 million square feet of covered storage, workshop space, hangars and general accommodation has been provided for the U.S. War Department, together with petrol and munition depots, garages ; and some 33 million square feet of open storage for the U.S. Army. Hospitals to the extent of nearly 100,000 beds have been specially built, or turned over, and all stores such as furniture, bedding, crockery and cooking utensils have been provided and maintained for the whole of the accommodation handed over.

By the end of June, 1944, 133 airfields, with their depots, headquarters and ancillary accommodation, had been provided for the U.S.A.A.F.

Excluding construction materials and petrol, U.S. forces in the United Kingdom received almost 6,800,000 ships' tons of supplies and equipment in the two years ended 30th June, 1944. Over half of this was provided in the last six months of that period.

31 per cent of all supplies and equipment currently required by the U.S. Army in the European theatre of operations between 1st June, 1942, and 30th June, 1944, was supplied as reciprocal aid.

Sparking plugs for certain U.S. aircraft have been wholly provided from United Kingdom production. Altogether 558,500 had been requisitioned up to 30th June, 1944, while in addition 600,000 plugs had been shipped to the United States.

U.S. forces in Britain have been provided with many other types of supplies, including bombs, shells, ammunition, anti-tank equipment, 2,104 aircraft (of which 500 were " Horsa " gliders), with an additional 570 aero-engines, 137,000 jettison fuel tanks, 50,000 pieces of armour plate for aircraft, 29,000 aero tyres, 22,000 aero tubes. 7,087,802 jerricans (specially constructed petrol cans) were delivered during the first six months of 1944.

The equipment and tools of a complete anti-aircraft gun barrel factory, and, for example, shell-producing plants, have been sent from Britain to the United States as reciprocal aid.

Britain has sent America, free of charge, machine-tools, anti-aircraft guns, ammunition, Rolls-Royce engines and thousands of barrage balloons.

Britain has supplied America with her newest inventions such as radiolocators, astrographs, and the jet-propulsion aero-engine.

Bailey Bridges were provided to U.S. forces as reciprocal aid, and the design was made available so that the bridge could be manufactured in the United States for use in other theatres of operations.

Rockets based on a British design are now being used by American forces against the Japanese in the Pacific.

Britain supplied the basic design for the American " Liberty " ship.

Many thousands of charts, in addition to regular supplies of charts to Washington, have been provided to U.S. warships and establishments concerned in invasion operations.

The items supplied as reciprocal aid range from the full use of the world's two greatest liners, the *Queen Mary* and *Queen Elizabeth*, to carry American troops across the ocean to the provision of 16 million boxes of matches for U.S. Army post exchanges ; from 14,120,000 rounds of ammunition and 587,000 smoke and other chemical warfare generators to 33,340,000 lb. of nails and 11,000 telegraph poles ; from 200 mobile wharf cranes and 180 miles of new railway track to 37,250,000 cakes of soap and 7,800,000 lb. of salt.

Quantities of radio equipment have been provided, including the total requirements of both the U.S. Eighth and Fifteenth Air Forces for one secret type of set, in the first six months of 1944.

Transportation of U.S. army stores and personnel during the six months ended 30th June, 1944, required 650,000 wagons and 9,225 special trains. 19 ambulance trains and 16 mobile workshops and breakdown trains were put at the disposal of the U.S. forces. In addition hundreds of thousands of tons of U.S. stores were transported by road and canal.

For the invasion operations extensive underground headquarters were constructed with an intricate system of communication for controlling shipping and small craft. In addition to the specially constructed landing craft bases, maintenance bases and embarkation facilities, items handed over to the U.S. forces included 2 complete floating docks, 2,110 pontoon units, about 200 cranes, 12 coasters and 30 lighters, 3 hospital carriers and 2 train ferry steamers adapted for use in damaged ports. For three months the entire output of Britain's sheet steel rolling industry was devoted to the waterproofing of many hundreds of U.S. wading tanks, as well as trucks and other mechanised equipment.

The most critical single project undertaken by the United Kingdom as reciprocal aid was the production in Britain of virtually all the artificial harbour equipment used on the beaches of France.

Britain does not waste manpower keeping detailed accounts of each item of aid, and no monetary value could in any case be put on many items. Subject to these limitations, the estimated value of aid furnished to the U.S. forces in Britain up to 30th June, 1944, was goods and services £343,632,000 and capital facilities £167,600,000. Food and raw materials exported to the United States by Britain up to 30th June, 1944, totalled £13,613,000 and other supplies exported to or transferred in the United States totalled £25,135,000. Aid afforded to U.S. forces in British Colonies and in overseas theatres of war amounted to £54,750,000. Grand total of these figures is £604,730,000.

(*b*) To the U.S.S.R.

> "*We shall give whatever help we can to Russia and the Russian people. We shall appeal to all our friends and allies in every part of the world to take the same course and pursue it, as we shall, faithfully and steadfastly to the end. We have offered the Government of Soviet Russia any technical or economic assistance which is in our power, and which is likely to be of service to them.*"
>
> RT. HON. WINSTON CHURCHILL, *22nd June*, 1941.

Britain has furnished war material free of cost to the U.S.S.R. since she became engaged in war with Germany. By September, 1941, Britain had already shipped to Russia substantial quantities of rubber, tin, wool, lead, jute and shellac.

Between 1st October, 1941, and 31st March, 1944, Britain supplied to Russia 5,031 tanks, 4,020 vehicles including lorries and ambulances, 2,463 Bren carriers and 1,706 motor cycles.

Weapons and ammunition supplied up to 31st March, 1944, included 300 P.I.A.T. with 85,000 rounds of ammunition, 636 2-pdr. anti-tank guns with 2,591,000 rounds of ammunition, and 3,200 Boys anti-tank rifles with 1,761,000 rounds of ammunition.

The total number of fighter aircraft despatched from Britain to Russia up to the end of March, 1944, was 6,778 (including 2,672 from the United States).

Naval supplies to Russia up to 31st March, 1944, included 9 mine-sweeping trawlers, 3 motor mine-sweepers, and 3,006 mines.

Industrial equipment supplied to Russia up to 31st March, 1944, included machine tools to the value of £8,218,000, power plant to the value of £4,250,000, electrical equipment to the value of £3,314,000, and various types of machinery to the value of £3,019,000.

Britain opened up a route to carry supplies across Persia, as well as sending quantities of materials by the northern sea route, by which 677 cargo ships (91·6%) out of a total of 739, which sailed, had arrived safely by March, 1945. 75 British warships of varying sizes escorted one of the largest convoys in the early autumn of 1942. Up to June, 1942, Britain provided nearly 90 per cent of the ships sailing by the northern route. In order to get the stuff to Russia by the northern route British convoys often had to beat their way through foul weather and heavy enemy attacks.

Half a million pairs of boots were shipped from Britain to Russia within one week of the German invasion of the U.S.S.R. By April, 1942, the entire 3,000,000 pairs of boots asked for by Russia had been shipped from Britain at a cost of 40,000 tons of shipping-space.

In four days alone the Quartermaster-General's Department of the British Army baled, packed and despatched to Russia enough greatcoat cloth to stretch from the White Sea to the Black Sea.

In the course of the year ended 30th June, 1944, supplies shipped to the U.S.S.R. included material for all three arms of the Soviet fighting forces. 1,042 tanks were sent, 6,135 miles of cable and over 2 million metres of camouflage netting. Naval supplies included 195 guns of various calibres with 4,644,930 rounds of ammunition.

The amount involved during the year to 30th June, 1944, is estimated at £90,457,000 and the total to that date at £269,457,000.

(c) To China and other Allies

> "*We are determined to extend to the Chinese people every material, moral, and spiritual help in our power.*"
>
> RT. HON. WINSTON CHURCHILL, *5th July*, 1942.

Britain has supplied, free of charge, arms, munitions and military equipment to Chinese forces in China within the limitations of transport from India.

In addition Chinese troops, in Burma and in India, have been given all they require locally, whether by issue from British Army stocks or by local purchase, including rations and pay in local currency together with cash for local purchases, on lend-lease terms.

In November, 1943, Britain had on loan to her Allies one cruiser, 14 destroyers, 17 corvettes, 6 submarines, 16 motor torpedo-boats, 17 motor launches, 19 mine-sweeping vessels and 4 frigates.

Credits formed most of the assistance which Britain gave to her Allies, other than the U.S.A. and the U.S.S.R., prior to her lend-lease arrangements with them. Britain's credits to her Allies, other than the U.S.A. and the U.S.S.R., together with such lend-lease assistance as Britain had provided before then, totalled about £186,000,000 by 31st December, 1942.

Up to 30th June, 1944, the estimated total of mutual aid afforded to China and other allies by Britain was £205,461,000. This consisted of: China £9,050,000, France £13,600,000 (up to 30th June, 1943, only), Poland £120,000,000 (provisional), Greece £12,368,000, Czechoslovakia £18, 629,000, Portugal £11,133,000, and Turkey £20,681,000.

The British Broadcasting Corporation has afforded to the Allied Governments in exile the opportunity of addressing their own broadcasts from London to their own people in German-occupied Europe, by enabling them to participate in the production of the BBC programmes or by giving them periods of "free time" for their own programmes. At the end of 1944 five European Allied Governments were receiving "free time" in the BBC services, totalling 2¾ hours daily, and in addition some of the Allied Governments we allocated time hired by the British Government on the Cairo transmitters.

At the end of 1944 the BBC was broadcasting to continental Europe a daily news service in 21 languages: English, French, German, Italian, Spanish, Portuguese, Norwegian, Swedish, Danish, Finnish, Albanian, Bulgarian, Czech, Dutch, Flemish, Greek, Hungarian, Polish, Rumanian, Serbo-Croat and Slovene. Additional transmissions in Luxembourg patois and Slovak made 23 languages in all.

There were 158 transmissions in every 24 hours in European languages including English for Europe, and many of these being simultaneous, the BBC was actually broadcasting to Europe for over 43 hours during a 24-hour day.

Up to the Allied invasion of Europe, daily half-hourly transmissions in morse brought the latest news to the editors of the hundreds of underground papers secretly published in the German-occupied countries.

At the end of 1944 the BBC was also broadcasting in Afrikaans, Arabic, Bengali, Burmese, Cantonese, Gaelic, Greek for Cyprus, Gujarati, Hindustani, Hokkien, Japanese, Kuoyu, Malay, Maltese, Marathi, Moroccan Arabic, Persian, Portuguese for Latin America, Sinhalese, Spanish for Latin America, Tamil, Thai, Turkish and Welsh, making a total of 47 languages in which broadcasts were being delivered.

10. THE ACHIEVEMENT OF BRITISH WAR PRODUCTION

Perspective

The immense achievements of British war production could have been made only by a great industrial nation whose workers accepted the demands of war as the first and almost the only claim upon their energies. The monthly output of munitions in the United Kingdom in the first half of 1944 was about six times as great as at the outbreak of war. This increase relates to the over-all rate of production of naval and merchant vessels, aircraft, ground munitions and other munitions and warlike stores. Of the total amount of munitions produced by, or made available to, the British Commonwealth and Empire since the beginning of the war, it is estimated that about seven-tenths has been produced in the United Kingdom, while about one-tenth has come from other Empire countries. The remaining one-fifth of Empire supplies has come from the United States ; of this total American contribution about one-fifth has taken the form of British cash purchases.

Performance

(*a*) Aircraft and Bombs

At the beginning of the war, total deliveries of new aircraft were at the rate of 730 a month, and over a quarter of these were trainers. By 1943 the average rate of deliveries had trebled, and as measured by structure-weight had increased nearly sixfold.

Output was changed to larger and more powerful types of aircraft, particularly heavy bombers. 2,889 heavy bombers were delivered in the first six months of 1944, compared with only 41 in the whole of 1940.

The total number of aircraft produced in the United Kingdom from September, 1939, to June, 1944, was 102,609, divided as follows :

Heavy bombers	10,018
Medium and light bombers	17,702
Fighters	38,025
Naval	6,208
Trainers	25,346
General reconnaissance, transport, air-sea rescue and others	5,310
	102,609

More than three-quarters of the total structure weight of aircraft delivered to the R.A.F. and Fleet Air Arm during 1943 was provided from production in Britain.

There are as many as 70,000 different pieces and shapes of fabricated materials in a single aircraft.

Engine output increased from 1,130 a month at the end of 1939 to an average of 5,270 a month between January and June, 1944. Over the same period the average horsepower of engines produced was doubled. The total number of engines produced from September, 1939, to June, 1944, was 208,701.

Repairs were made to 60,099 aircraft and 113,005 aero-engines from July, 1940, to June, 1944. For every 6 aircraft newly produced in 1943, 4 aircraft underwent major repairs in the United Kingdom.

Bomb loads increased with the size and power of the bombers produced. In 1939 the average bomb load was 1·2 tons per bomber ; in 1943 it was 4·0 tons.

The weight of bombs which could be carried a distance of 1,000 miles in one sortie by the monthly output of bombers increased from 210 tons in 1939 to more than 3,000 tons at the beginning of 1944.

The weight of filled bombs produced from the beginning of the war to June, 1944, was 973,400 tons.

The bombs in general use in 1940 weighed 500 lb. In March, 1942, 4,000-lb. bombs were used for the first time, in September, 1942, bombs weighing 8,000 lb. came into use, and in March, 1944, 12,000-lb. bombs were being used. A year later the use of a 22,000-lb. bomb was announced.

(*b*) Ships

From September, 1939, to June, 1944, the production of naval vessels in the United Kingdom was as follows :

Major naval vessels	722
Mosquito naval craft	1,386
Other naval vessels (including landing craft)	3,636

The manpower available for shipbuilding has necessarily been limited by the vital need for aircraft and army equipment after the earlier German successes, and also by the large number of men required for the refit and repair of ships continuously at sea and frequently in action.

Britain has concentrated her main effort on naval work. It was announced in March, 1944, that about 70 per cent of her total effort in new construction was devoted to it.

It is now necessary to arm regular warships with many offensive and defensive weapons additional to those fitted in the early stages of the war. Much additional equipment is required in the way of radar and wireless apparatus, control gear and devices for protection against the various forms of enemy attack, including surface craft, U-boats, aircraft and mines of the magnetic and other types.

The increase in ships has called for an even greater increase in naval munitions, production of which from September, 1939, to June, 1944, was as follows :

Naval guns	49,865
Ammunition (excluding 20 mm.) ..	33,335,000 rounds
Mines and depth charges	897,274
Torpedoes	17,677

The tonnage of merchant vessels constructed in the United Kingdom in the years 1940 to 1943 averaged nearly one-fifth more than in the years 1915 to 1918. Many of these vessels were of types specially designed to meet particular operational and other war needs, and were not adaptable to methods of mass construction. The gross tonnage completed from September, 1939, to the end of 1943 was 4,717,000.

Practically every merchant ship must be equipped with complete defensive armament including many of the weapons and devices fitted in war vessels.

At one period the amount of merchant shipping in hand for repair was over 2½ million gross tons.

(*c*) Tanks and Vehicles

Output of tanks from September, 1939, to June, 1944, was 25,116, of carriers and armoured cars 74,802, and of wheeled vehicles for the Services 919,111.

Fighting vehicles are now heavier and more highly powered than they were at the outbreak of war.

(*d*) Guns, Ammunition and other Supplies

From September, 1939, to June, 1944, the following ground munitions were produced :

Field, medium and heavy artillery equipments ..	13,512
Heavy anti-aircraft equipments	6,294
Light anti-aircraft equipments	15,324
Machine guns and sub-machine guns	3,729,921
Rifles	2,001,949
Gun ammunition	161,100,000 rounds
20-mm. ammunition	387,700,000 rounds
Small arms ammunition	8,285,000,000 rounds
Grenades	80,983,000
Lines of communication cables	3,009,200 miles
Telephones	486,200
Wireless stations	445,500
Reception sets	34,227

Ammunition has not only grown in weight since the war began, but has become more complicated and difficult to make.

Wireless sets and other types of signal equipment have become much more elaborate.

A wide range of specialised stores, sometimes of a very bulky character, was made to facilitate the landings in Western Europe.

(*e*) Raw Materials

The output of iron ore in the United Kingdom has been increased by one-half since before the war, output in 1943 being 18,487,000 tons as compared with an average over the years 1935-38 of 12,417,000 tons.

The total steel production has been well above the pre-war average, being 13 million tons in 1943 as compared with an average of 11¼ million tons for the years 1935-38.

The production of timber has been increased, and in 1943 was more than four times as great as at the outbreak of war.

Some of the most outstanding increases in production have been made by the light metals industries to meet the requirements of aircraft and incendiary bomb production. Magnesium production is more than eleven times the pre-war rate (23,000 tons in 1943 as compared with an average of 2,000 tons in the years 1935-38). Production of aluminium rose from an average of 18,000 tons in 1935-38 to 56,000 tons in 1943.

11. THE ACHIEVEMENT OF BRITISH AGRICULTURE

> *"During the war immense advances have been made by the agricultural industry. The position of the farmers has been improved ; the position of the labourers immeasurably improved."*
>
> RT. HON. WINSTON CHURCHILL, 21*st March*, 1943.

Perspective

Because of the high degree of industrialisation in Britain and the size of the population in relation to the total area, the country cannot be entirely self-supporting in foodstuffs. Nevertheless, British farmers have done a great war job in cutting down the import of food and relieving the strain on shipping to the utmost by bringing land back to cultivation and by improving the fertility and output of the land by the best possible methods of drainage and mechanised farming. The master plan in policy for production has been to change the island from a mainly grazing to a mainly arable country, to save a round voyage for a ship with every 10,000 tons of food grown.

The net loss of land to military and non-agricultural uses exceeded the area reclaimed or brought back to cultivation by 600,000 acres at the end of 1944. The increased production of British agriculture has, therefore, been achieved on an acreage smaller by that amount, by increasing the actual physical yield of the land and by increasing the proportion of crops available for direct human consumption.

Performance

As a result of the ploughing-up campaign, the area of arable land in the United Kingdom has increased by 43 per cent since shortly before the war. 7,000,000 acres of grassland have been ploughed up. Tillage has increased by 62 per cent.

In terms of shipping space saved, the United Kingdom's food production has increased by 120 per cent. since before the war, and in terms of food values, by 70 per cent. The country is producing more food per acre than any country in the world, and also more food per man per acre.

Half the wheat used in the composition of national flour is home produced.

Production of wheat, barley and potatoes has more than doubled ; production of oats and fruit is up by one half and of sugar beet and vegetables by one third.

To maintain the production of milk and to offset the reduction in imports of animal feeding-stuffs larger quantities of fodder crops have been grown.

To achieve a national output of nearly 7 million tons of ware potatoes the production of certified seed potatoes in the United Kingdom has been greatly increased from a figure of some 150,000 tons pre-war to over half a million tons in 1944.

There are nearly 1,708,300 allotments in the United Kingdom. In 1942 over £15,000,000 worth of vegetables was produced.

Britain now grows about half her sugar consumption, that is, sufficient for the domestic sugar ration.

Farmers and County Committees in the United Kingdom have spent something like £100,000,000 during the war on machinery alone.

The United Kingdom is to-day the most highly mechanised farming country in Europe and has increased the number of tractors on the land by well over 170 per cent.

Under the Agricultural Goods and Services Scheme, assistance for farmers during the year 1942 was provided up to the value of almost £2 million sterling.

In order that land might receive appropriate treatment, the number of soil samples given laboratory tests by Advisory Chemists or tested in the field during 1943 cannot have been far short of 200,000.

Britain has closed the gap between the farmer and the scientist by setting up an Agricultural Improvement Council which ensures that modern research work is made known to farmers and applied in practice.

From September, 1939, up to the end of August, 1944, over 150,500 farm drainage schemes have been approved, affecting over 3¾ million acres and costing nearly £6,500,000.

In addition over £5,250,000 worth of schemes on minor water courses and £4,500,000 worth of main river schemes had been approved for execution during the war. Also, over £1,000,000 has been spent on drainage and machinery.

The result of the agricultural products programme has been, that coupled with the planning and control of food distribution, it had become possible by 1943 to maintain total food supplies at an adequate level, while at the same time reducing imports of food by 50 per cent, thus releasing an equivalent amount of shipping for other war purposes. The cost of this achievement was the sacrifice of 6½ million sheep, 2½ million pigs and 19¼ million poultry.

12. THE ACHIEVEMENT OF BRITISH INLAND TRANSPORT AND COMMUNICATIONS

> "*Throughout the period of the heavy German air-raids on this country the arteries of the nation, the railways, with their extensive dock undertakings, were subjected to intensive attacks. . . . In spite of every enemy effort the traffic has been kept moving and the great flow of munitions proceeds. Results such as the railways have achieved are only won by blood and sweat.*"
>
> RT. HON. WINSTON CHURCHILL, *December*, 1943.

Perspective

War-time communications within Britain have been carried on under all the strain of threatened and actual air attack, of shortage of manpower, of change of emphasis and consequent reorganisation. The General Post Office in particular has had not merely to maintain but greatly to increase its services for upon it has fallen the main burden of ensuring the facilities for rapid co-ordination within a country often the scene of active operations and always the base for others.

Britain's main-line railways cover 20,000 route miles. Central Wagon Control directs all wagons where they are most needed, and the Central Operating Conference confers every morning by telephone about big traffic movements. The intimate interrelation between railways and shipping in Britain's war-time transport was reflected by the merger of the Ministry of Shipping with the Ministry of Transport in 1941. Under the resultant Ministry of War Transport, shipping and inland transport have been rendered one continuous, co-ordinated operation from ships, through docks, railways, canals and roads.

Performance

British railways are carrying half as much traffic again as they did before the war. 113,000 railwaymen have been called up. 50 passenger trains have been lost in air raids.

1,623 million miles were run by trains operated by the main-line railways between the outbreak of war and the end of 1943.

More than 20,000 goods trains a week are being run, and nearly 1,000,000 loaded wagons. Through one main-line junction alone 3,000 wagons pass every 24 hours in each direction.

4,052 million miles were run by loaded freight wagons in 1943. Since the beginning of the war the tonnage of freight carried by the railways and the average length of haul have both increased, so that the work done by the railways measured by net ton miles has risen by about 40 per cent.

Since the outbreak of war more than 353,000 special trains have been run for troops and their equipment.

The number of passenger-train miles is now 30 per cent below the pre-war level, and the average load carried by passenger trains is 125 per cent greater than before the war.

There are now no excursions at all. (In peace time there were 17,500 half-day and evening excursions during the summer.) Instead there are 1,000 extra trains every day to carry workers to and from government factories alone.

In 1943 locomotives spent 7,500,000 more hours in traffic than in 1938, while the number available for work had increased by only 1 per cent.

Over 35,000 railway-owned wagons are repaired each week.

Amenities of travel have gone. In peace time there were 870 restaurant car services in operation. Now there are none.

At the time of Dunkirk, 620 emergency trains were run in eight days, carrying 300,000 troops from seven ports in the south-east of England. At the busiest time, 110 special trains were worked in 24 hours.

At the end of 1941, locomotives and other rolling-stock were rushed to Persia to speed up supplies to Russia over the Trans-Persian Railway. 143 locomotives, specially equipped, with tenders and spare parts, were sent, and 1,600 steel-frame 12-ton wagons were built in record time. By working night and day the assembling works fitted together the 1,800 parts of each wagon so that one was completed every 37 minutes.

Preparations for the North African Expedition involved the running of 440 special troop trains, 680 special freight trains, and 15,000 railway wagons by ordinary goods services, to carry men and materials to the embarkation ports.

From 26th March, 1944, to the completion of the initial D-Day moves, British railways ran 24,459 special troop, ammunition and stores trains. Among other vital war traffics these trains carried some 7,000 vehicles including tanks. More than 6,000 wagon-loads of supplies and equipment were also sent by ordinary goods trains. During the three weeks before D-Day, the movement of special trains reached its peak. In one week all war-time records were surpassed with the running of 3,636 special trains, and the total for the three weeks was no fewer than 9,679 trains.

Road transport, by reason of its flexibility, has been of great service in the war effort both on the passenger and goods sides, and has been especially valuable in meeting emergency calls.

Considerable restrictions have been imposed on bus services. In 1941 long-distance express services were drastically curtailed, with the result that the total mileage of all bus routes in the country was reduced by 40 per cent. Many bus undertakings have had to carry from 30 to 50 per cent more passengers than in 1938.

Long-distance road goods vehicles have been taken over by the Government and are operated by the Ministry of War Transport. This direct form of control is intended to concentrate the traffic in the fewest possible vehicles and to ensure that enough vehicles are available in areas where they are urgently needed.

During the winter of 1943-4, this organisation performed invaluable work in helping to move the immense cargoes which were being unloaded in the ports, in transporting meat to army camps and depots, in carrying prefabricated parts of ships for assembly at the shipyards, and in moving other loads too unwieldy to go by rail.

The organisation was also assigned an important part in the preparations for the landings in France. Its job included the movement to embarkation ports of large numbers of landing craft, some of them weighing as much as 40 tons, together with cased gliders, aero-engines, steam rollers and bulldozers, and thousands of tons of foodstuffs. During the peak period the organisation was moving cargo at the rate of over 1,000,000 tons a week.

Canals, too, have been brought under governmental control. 10,000 boats and barges carrying 1,000,000 tons a month help to reduce pressure on the railways. Half of this total is represented by fuel, the remainder is made up of heavy bulk cargoes such as building materials, munitions, fertilisers, manufactured foodstuffs and home-grown grain.

The canals' part in the preparations for D-Day consisted in carrying blocks of traffic which would normally have gone by road or rail, thus releasing vehicles for more urgent work.

Coastal shipping is being used to the fullest possible extent both for off-loading from deep-sea vessels and also for long-distance carriage of coal and other home products. There has been a marked increase in the tonnage carried by each ship.

Coasters have also played an indispensable part in military operations in the Mediterranean and in carrying troops and supplies to France.

The General Post Office plays an important part in the communications of Britain. It operates 24,000 post offices, 5,800 telephone exchanges, 51,400 telephone call offices and 3,700,000 telephone stations.

Since the outbreak of war the Post Office has not only had to provide for an increase in almost every branch of its normal business, but for an ever-increasing range of new activities under constantly changing conditions, including measures for the continuance of services during and after air raids.

Teleprinter working has been adopted on all but the lightly loaded telegraph routes. In 1942-43 the number of inland telegrams handled was 64,000,000, compared with about 48,000,000 a year before the war.

The Post Office is responsible for the maintenance of communications with the police, ambulance and other similar services. The warning of the approach of enemy aircraft is spread by the ordinary Post Office network to points from which the air raid siren warnings are operated.

Britain has built an elaborate interconnected oil pipeline system extending over 1,000 miles from N.W. ports to the Channel. Five million gallons flow through it daily. Later the pipelines were carried under the Channel to serve the advancing 21st Army Group.

The system is studded with scores of secret underground storage tanks for holding large reserve stocks. This line places fuel supplies directly into the centre of nests of airfields, and eases the strain on other methods of transport.

13. THE ACHIEVEMENT OF BRITISH WAR ECONOMY

> " *This is no time for ease and comfort. It is the time to dare and endure. That is why we are rationing ourselves, even while our resources are expanding. That is why we mean to regulate every ton that is carried across the sea and make sure that it is carried solely for the purpose of victory.*"
>
> RT. HON. WINSTON CHURCHILL, 27*th January*, 1940.

Perspective

Britain has mobilised her resources for war in four main ways : by increasing the total volume of production ; by reducing civilian consumption ; by drawing on capital at home ; by drawing on capital abroad. The national resources have been switched over from a peace-time economy to a war economy by direct control and rationing and by financial methods. Direct control applies to labour, raw materials and industrial capacity, to imports and exports, to the amount and type of goods manufactured and supplied. Civilian consumption has been notably reduced not only in quantity but also in quality, and that very extensively.

Performance

(*a*) Taxation

In 1944, it is estimated, about 36 per cent of Britain's gross national income went in taxes, including compulsory contributions for social insurance and war risks or damage. This compares with 22 per cent in 1938.

In the financial year 1944-5, the British Inland Revenue netted in taxes nearly four times the amount collected in 1938-9 : £2,029 million as against £520 million. And that relates only to the budget of the central government. [Inland Revenue includes Income Tax, Surtax, Estate Duties, Stamps (Inland Revenue), National Defence Contribution, Excess Profits Tax, etc.]

53 per cent of total Government expenditure in 1944-5 was provided by taxation and other Government revenue.

The number of income tax payers increased from 4 million in 1938-9 to 13 million in 1943-4.

In Britain a single person earning £500 a year now pays £156 of it away in income tax ; if he earns £1,000 he pays £381. On unearned income the tax is even higher. A married couple with two children and an unearned income of £100,000 would have £5,830 left after taxation—94 per cent of their income gone.

Indirect taxation in 1944-5 brought in £1,105 million, against £376 million in 1938-9.

20 cigarettes now cost 2s. 4d. in Britain ; three-quarters of the price (1s. 9d.) goes to the Exchequer in duty.

The duty on beer, at the present reduced average strength, accounts for well over half the price (7½d. out of 1s. a pint).

Even on tea, the staple drink of British working families, 6d. is paid in duty on a pound bringing the cost to 2s. 10d.

On a wide range of luxury goods a purchase tax amounting to 100 per cent of the wholesale value must be paid. And on a very wide range of other goods for civilian consumption there is a purchase tax of one-third or one-sixth of the wholesale value.

(*b*) Restriction

The adult people of Britain are on small rations of meat, milk, eggs, butter, margarine, cooking fats, bacon, ham, sugar, tea, preserves, sweets and chocolate.

Purchase-control by a flexible rationing system by " points " further applies to canned meat, canned fish, canned beans, dried fruit, rice, sago, tapioca, dried pulses, canned fruit, canned peas, canned tomatoes, canned milk, breakfast cereals, oat flakes, syrup, treacle and biscuits.

There is now no white bread in Britain, no bananas, and little imported fruit at all.

27 per cent less fresh meat, 56 per cent fewer shell eggs, 35 per cent less sugar, 69 per cent less butter, and 56 per cent less fresh fruit are being eaten on an average in Britain now than before the war. Potato consumption has gone up 54 per cent.

Standardisation of many commodities, and "zoning" of their distribution so that cross-hauls are cut out, saves internal transport. Shipping space is saved by using milk and eggs in their dehydrated form. Dried egg enables the equivalent of shell eggs to be imported in a fifth of the tonnage.

The ordinary person who cannot show urgent necessity for using his car is allowed no petrol at all.

Travel by rail is considerably more expensive and more restricted than in normal times. There are no more excursions or special holiday trains in Britain.

The production of many articles such as motor-cars, refrigerators, pianos, vacuum-cleaners and lawn-mowers has been completely suspended from 1942 or earlier, while the production of cutlery, wireless sets and valves, bicycles, watches and fountain pens has been drastically curtailed. For example, only 540,000 civilian bicycles were produced in 1943 as compared with 1,600,000 in 1935, and the production of civilian wireless sets during the same period was reduced from 1,900,000 to 50,000.

British potteries normally produced 67 shapes of cup. Now they are producing three. The normal range of hardware products has been cut by 60 per cent.

Clothes are strictly rationed and the supply available is about half what it was before the war.

Only standardised " utility " furniture may now be made. This economical furniture conforms to specified descriptions and measurements, and there is only enough of it to supply urgent needs, such as those of the newly-married or bombed-out. Purchase is by permit.

Linen sheets are no longer made. The manufacture of quilts and bedspreads has been cut to a minimum and no table-cloths at all are produced.

Purchases of furniture, furnishings and household textiles have been reduced to about one-fifth of the peace-time quantity, and to one-third in the case of hardware.

Concentration of production had been applied by March, 1944, to nearly 70 branches of industry. 3,620 establishments had been closed, thus freeing manpower and plant for essential war purposes.

(*c*) **Saving**

During five years of war Britain's housewives and Local Authorities collected nearly 6 million tons of salvage.

Over 5,000,000 tons was the total of scrap metal collected from all sources from November, 1939, to May, 1944.

Over 100 million books have so far been collected in a national drive to collect books for the armed forces, for restocking bombed libraries and for salvage.

During the winter of 1942-3 British domestic and industrial consumers of coal effected an economy of 11,000,000 tons in response to the request and advice of the Government. This saving was 3,000,000 tons greater than the advance official estimate.

There were over 298,000 Savings Groups in the United Kingdom in December, 1944.

Over £469 million was raised for the war savings campaign in War Weapons Weeks held between September, 1940, and June, 1941. This is an approximate average of £10 per head of the British population.

Over £545½ million was raised during Warships Weeks between October, 1941, and March, 1942. The amount raised in England and Wales alone (nearly £478 million) was equivalent to the cost of building 5 battleships, 4 aircraft carriers, 45 cruisers, 300 destroyers, 160 corvettes, 33 submarines, 267 minesweepers, 124 motor torpedo-boats, 117 depot ships, sloops, monitors, etc.

Over £616 million was raised for the war savings campaign during Wings for Victory Weeks between March, 1943, and July, 1943.

Over £626 million was raised during the Salute the Soldier campaign between March, 1944, and July, 1944.

Over £8,467 million had been lent to the Government up to December, 1944. That is an average of £177 per head of the British population.

Out of every £100 received by the average British citizen in 1943 he saved £19—and paid in taxes £36—leaving only £45 for " living."

14. THE ACHIEVEMENT OF THE BRITISH SPIRIT

The British spirit has been a factor in the Allied war potential of greater importance than any strategic effort or industrial output. Hard as it may be to measure, it must be included in a summary of the British achievement.

A dogged perseverance has been part of it. The very unwillingness to be diverted from everyday pursuits, which brought the British people to so late a realisation of their peril and the world's, engendered a deep determination to see the war through, at whatever cost, to the only possible conclusion. So Britain became the point round which all resistance to aggression could coalesce.

Endurance has certainly been called for and has not been lacking. " Grim and gay " aptly described the way the British felt and acted under the Blitz and the threat of invasion.

Exaltation has had its moments too. It was the key to the British mood in 1940, when the sense of danger and responsibility gave to the national character a sharper identity than ever before.

A determination to plan for a future beyond victory has helped to sustain the British spirit throughout the war and has produced the spectacle of a nation with its life in peril nevertheless carrying through domestic reforms of unparalleled magnitude.

This spirit has certainly had effects beyond the bounds of the nation. The planning and organisation of the Grand Alliance have been the fruit of a popular determination to make friends of Allies, expressed and interpreted by wise leadership.

The grand achievement of the British spirit has been that it has risen to the occasion in many hours full of peril, bringing salvation to Britain, to her Allies and to the world.

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